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COPPER RIVER HYDROACOUSTIC SALMON ENUMERATION STUDIES, 1988 THROUGH 1991

By

Steven Morstad

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ABSTRACT

The Miles Lake sonar project began in 1978 to assess annual salmon escapement into the Copper River. Studies conducted during 1988 through 1991 used side scanning sonar equipment deployed on the north and south banks of the Copper River. Counting sites were located near the outlet of Miles Lake approximately 53 km upstream from the commercial fishing district. Escapement estimates for sockeye salmon (*Oncorhynchus nerka*) were 488,398 in 1988, 607,797 in 1989, 581,859 in 1990 and 579,435 in 1991. Use of riverine sonar units which were capable of dividing the sonar beam into 16 monitoring sectors, each with adjustable hit criteria for targets, improved the accuracy of escapement estimates and allowed observations of salmon distribution across the counting transect to be obtained.

KEY WORDS: Copper River, hydroacoustics, migration, Miles Lake, *Oncorhynchus nerka*, Pacific salmon, riverine sonar, sockeye salmon, side scanning sonar, spawning escapement enumeration

INTRODUCTION

The Copper River drainage (Figure 1) has supported a commercial fishery since the early 1890's and a subsistence life style for the residents of this drainage for many years before that. Five species of pacific salmon spawn in the Copper River. The most abundant species is sockeye salmon which makes up 92 percent of the total run. Coho salmon (*O. kisutch*) comprise approximately five percent and chinook salmon (*O. tshawytscha*) make up about three percent of the total run. Populations of pink (*O. gorbuscha*) and chum (*O. keta*) salmon are not abundant.

There are three major sockeye salmon spawning components in the Copper River system. The most abundant component, referred to as upper Copper River stocks, spawn in Copper River tributaries above Miles Lake. The second component, derived from upper Copper River stocks, is an artificially propagated Gulkana River hatchery stock. The hatchery, which has operated since the early 1970's, produces approximately 225,000 returning adult sockeye salmon. The third component, referred to as lower delta stocks, spawn in systems below the Chugach Mountains, between Eyak Lake and Katalla River.

Management of Copper River salmon resources are difficult due to several factors. The Copper River is a cold turbid system draining extensive glaciers originating in the Alaska, Chugach, Wrangell, and St. Elias mountain ranges. Enumerating the escapement within this drainage has been difficult since the main stem Copper River is too turbid to allow visual counting of salmon. While it is possible to survey clear tributary streams, sockeye and chinook salmon reach these months after they have passed through the commercial fishery. Such surveys have little value for inseason management decisions and make it impossible to ensure that minimum escapement levels are achieved. However, post season escapement estimates do provide data to forecast subsequent runs and to establish escapement goals.

Inseason escapement estimates first became possible in 1978, with the deployment of a single side scanning sonar salmon counter on the south bank of the Copper River at the outlet of Miles Lake (Mile 49 of the Copper River Highway) approximately 53 km upstream from the commercial fishing zone. In 1979 an additional side scanning unit was installed on the north bank of the river. Information from this project has been used for real time management of both the commercial and personal use fisheries. The Copper River management plan 5AAC 29.360 specifies minimum escapement goals which are based on data obtained from this sonar project (ADF&G 1991). Emergency order regulation of the multi-million dollar commercial fishery as well as subsistence, personal use, and sport fisheries is based on escapement information
collected at the Miles Lake sonar site.

METHODS

To estimate total escapement, the sonar system must be placed in an area of the river where salmon do not mill and all salmon traveling upriver have a high probability of passing through the sounding beam. An area of the river with a single channel, uniform slope, smooth bottom and adequate current velocity is most desirable. The most suitable location, closest to the river mouth, was found just downstream of Miles Lake. This site is 53 km above the upper commercial district boundary. This section of the river is influenced by two glaciers: Childs Glacier, which is below Miles Lake, and Miles Glacier, which is on the eastern shore of Miles Lake (Figure 2). Although the Copper River Highway provides access to the site, deep snow drifts render the highway impassable well into June most years. Since sonar gear is deployed in the river at the earliest date that breakup conditions allow, other means of transportation to the site prior to the road opening have included track vehicles, snow machines, fixed wing aircraft, chartered helicopters, and the Coast Guard helicopter.

Sonar Operations

The basic adult salmon counter system consists of four main elements: an electronic counting unit, a transducer, an artificial bottom substrate, and an oscilloscope for calibration. The system is powered by a 12 volt battery continuously recharged by a solar panel.

Electronic counting units used on this project varied within and between years. Two 16 sector, 1985 Bendix units with adjustable hit criteria by sector are currently used. Two 12 sector 1981, Bendix units with rock inhibiting functions are available to replace 16 sector units which malfunction or are damaged.

Transducers operate at 515 KHz and have alternating beam widths of 2 and 4 degrees. Each transducer is mounted on an underwater stand near the river bank and aimed horizontally across the river so that the beam is perpendicular to the current and slightly off the bottom. This allows monitoring of that portion of river most frequently used by migrating sockeye salmon (Brady, 1986). Each transducer is aimed over either an artificial bottom substrate with a smooth straight surface or the natural river bottom where the slope is smooth and uniform. A permanent artificial substrate has been constructed at the south bank site by embedding a steel rail in concrete to form a uniform surface along the river bottom. The rail also serves as a guide along which the transducer stand is moved in response to water level fluctuations.

A minimum water level of 40.1 meters (above sea level) is needed for use of the permanent

substrate. When water levels are lower, a portable substrate is used. This consist of an 18 meter length of 20.3 cm diameter aluminum tube which is held in place against the current by cables. Transducer deployment over natural bottom was first tried in 1985 (Brady, 1986).

Transducer aiming is executed differently over artificial substrates and natural bottoms. Aiming along the artificial substrate requires a target at the end of the tube. The target used is an aluminum rectangle 30 cm high and 20 cm wide. When the target appears on the oscilloscope, the counting range of the sonar unit is reduced so that it ends just before the target. Aiming is accomplished by adjusting three knobs on the back of the transducer housing while underwater. To count salmon over a natural bottom, the transducer is attached to a tripod. Aiming is controlled by a wheel at the top of the stand which moves the transducer up and down. To direct the beam up- or downriver, the entire tripod is shifted in the desired direction.

Each year, frequent adjustments of substrates and transducers have been required on both river banks because of large fluctuations in river level, wave action caused by strong winds, and periods of heavy ice passage. During 1988 through 1990, electronic counting units were calibrated four times each day by visually monitoring targets on the oscilloscope. In 1991, the south bank unit was calibrated every two hours for 30 minutes or until 100 fish were counted, which ever occurred first. The north bank sonar was calibrated every four hours for 30 minutes or until 100 fish were counted (Morstad 1991).

Species Apportionment

Due to similar run timing of chinook and sockeye salmon during May and early June, and since 95 percent of salmon migrating up the Copper River are sockeye, no species apportionment information is collected at the site. Test fishing programs were attempted from 1985 through 1987, but limited locations and small catches demonstrated that test fishing was not practical at Miles Lake (Morstad, 1992).

Helicopter Charter

A U.S. Coast Guard rescue helicopter with a load capacity of 4,000 pounds was used to haul equipment, supplies and personnel into the Miles Lake camp in 1988, 1989 and 1990. In 1991, the project spent $5,000 to have the Alaska Department of Transportation clear snow and open the highway to vehicle traffic on 15 May.

RESULTS and DISCUSSION

Escapement Enumeration

In 1988, the sonar project was operated from 19 May to 2 August. Estimated escapement during that time period was 488,398 salmon about six percent above the escapement goal of 458,200 (Table 1). Actual daily counts were similar to anticipated counts during most of season (Figure 3). Water level of the Copper River was below normal, yet escapement was slightly above the anticipated (Table 2).

In 1989, the sonar project operated from 17 May to 2 August. Estimated escapement during that time period was 607,797 salmon, 25 percent above the escapement goal (Table 3). Actual daily counts for 1989 were above the anticipated counts throughout the season (Figure 4). Slight decreases in daily escapement occurred which were probably caused by the commercial fishery harvest. The Copper River water level was above normal all season. This may have been a contributing factor to the high escapement levels observed (Table 2).

In 1990, the sonar project operated from 21 May to 2 August. Estimated escapement during that time period was 581, 859 salmon, 16 percent above the escapement goal (Table 4). Actual daily counts for 1990 were similar to 1988 and 1989, with actual counts above the anticipated counts throughout most of the season (Figure 5). Slight drops in daily counts again reflected commercial fishing removals which occurred at the mouth of the Copper River. The water level was above normal for 1990, allowing salmon to enter the Copper River earlier than in past years (Table 2).

In 1991, the sonar project operated from 21 May to 2 August. Estimated escapement during that time period was 579,435 salmon, 12 percent above the escapement goal (Table 5). Actual daily counts were below anticipated counts until 1 June when daily counts surged from 9,000 to over 16,000 salmon (Figure 6). However, actual cumulative escapement remained below the anticipated level until 20 June. After that date, actual escapement surpassed and remained above anticipated levels for the remainder of the season. Water level was below average until 13 June (Table 2).

Sector Distribution

As observed in previous years, salmon passage during 1988 through 1991 was concentrated near shore in the first three sectors of the sonar beam (Figures 7-10), (Morstad, 1991 and Brady, 1986).

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Table 1. Daily sockeye salmon escapement estimates, Miles Lake sonar, 1988.

Date	Water Level [a]	Estimate				Escapement Objective	
		North Bank	South Bank	Daily	Cumulative	Daily	Cumulative
19–May	39.65		313	313	313	1,098	2,495
20–May	39.65		877	877	1,190	1,197	3,692
21–May	39.60		1,440	1,440	2,630	1,247	4,939
22–May	39.61		2,256	2,256	4,886	1,297	6,236
23–May	39.64		5,078	5,078	9,964	2,070	8,306
24–May	39.67		11,033	11,033	20,997	3,207	11,513
25–May	39.75		9,979	9,979	30,976	3,534	15,047
26–May	39.78		8,946	8,946	39,922	3,970	19,017
27–May	39.82		13,247	13,247	53,169	5,921	24,938
28–May	39.87	345	13,856	14,201	67,370	9,295	34,234
29–May	40.00	513	9,509	10,022	77,392	5,923	40,156
30–May	40.12	381	6,425	6,806	84,198	8,399	48,555
31–May	40.14	821	6,765	7,586	91,784	10,464	59,020
01–Jun	40.16	498	4,707	5,205	96,989	10,324	69,344
02–Jun	40.26	378	3,180	3,558	100,547	12,633	81,977
03–Jun	40.32	239	4,387 [b]	4,626	105,173	11,892	93,869
04–Jun	40.35	741	7,136	7,877	113,050	13,922	107,790
05–Jun	40.61	469	6,286	6,755	119,805	15,506	123,296
06–Jun	40.82	394	8,501	8,895	128,700	13,904	137,201
07–Jun	41.15	163	8,933	9,096	137,796	13,168	150,369
08–Jun	41.48	223	11,099	11,322	149,118	14,855	165,224
09–Jun	41.80	537	14,104	14,641	163,759	14,770	179,994
10–Jun	42.00	624	14,592	15,216	178,975	13,023	193,017
11–Jun	42.19	833	15,422	16,255	195,230	12,402	205,419
12–Jun	42.36	983	13,976	14,959	210,189	10,052	215,471
13–Jun	42.45	732	10,019	10,751	220,940	9,442	224,913
14–Jun	42.64	811	8,571	9,382	230,322	9,020	233,933
15–Jun	42.80	542	9,368	9,910	240,232	9,035	242,968
16–Jun	42.99	421	6,063	6,484	246,716	8,680	251,648
17–Jun	42.90	384	4,526	4,910	251,626	8,637	260,285
18–Jun	42.56	698	5,771	6,469	258,095	7,706	267,991
19–Jun	42.32	454	7,401	7,855	265,950	6,110	274,100
20–Jun	42.53	372	7,580	7,952	273,902	5,386	279,486
21–Jun	42.25	507	5,263	5,770	279,672	5,484	284,970
22–Jun	41.82	386	6,599	6,985	286,657	5,811	290,781
23–Jun	41.73	409	7,290	7,699	294,356	6,615	297,396
24–Jun	41.68	410	5,172	5,582	299,938	6,801	304,197
25–Jun	41.68	265	5,332	5,597	305,535	6,374	310,571
26–Jun	41.55	369	6,009	6,378	311,913	5,325	315,896
27–Jun	41.79	268	6,291	6,559	318,472	4,455	320,351
28–Jun	41.79	196	6,063	6,259	324,731	4,224	324,575
29–Jun	41.73	127	8,093	8,220	332,951	4,237	328,812
30–Jun	41.82	242	6,255	6,497	339,448	3,970	332,782

–Continued–

Table 1. (page 2 of 2).

Date	Water Level [a]	Estimate				Escapement Objective	
		North Bank	South Bank	Daily	Cumulative	Daily	Cumulative
01–Jul	41.99	155	5,447	5,602	345,050	4,081	336,863
02–Jul	42.29	108	4,572	4,680	349,730	4,882	341,745
03–Jul	42.51	166	4,056	4,222	353,952	5,034	346,780
04–Jul	42.66	178	3,354	3,532	357,484	5,884	352,664
05–Jul	42.95	151	3,153	3,304	360,788	4,778	357,442
06–Jul	43.08	177	3,333	3,510	364,298	4,464	361,905
07–Jul	43.06	81	4,243	4,324	368,622	4,148	366,053
08–Jul	42.94	194	8,305	8,499	377,121	3,951	370,004
09–Jul	42.72	181	4,986	5,167	382,288	4,211	374,216
10–Jul	42.53	254	6,093	6,347	388,635	5,404	379,620
11–Jul	42.72	329	7,291	7,620	396,255	4,577	384,197
12–Jul	42.73	301	7,580	7,881	404,136	4,555	388,753
13–Jul	42.66	325	6,762	7,087	411,223	3,809	392,562
14–Jul	42.64	248	6,764	7,012	418,235	4,297	396,858
15–Jul	42.72	248	6,676	6,924	425,159	4,467	401,325
16–Jul	43.03	202	5,255	5,457	430,616	4,628	405,953
17–Jul	43.18	247	4,630	4,877	435,493	4,264	410,217
18–Jul	43.18	121	3,736	3,857	439,350	5,106	415,323
19–Jul	43.24	170	4,413	4,583	443,933	6,062	421,385
20–Jul	43.53	178	4,305	4,483	448,416	5,951	427,336
21–Jul	43.40	154	3,810	3,964	452,380	4,668	432,004
22–Jul	43.38	114	2,683	2,797	455,177	3,306	435,311
23–Jul	43.04	149	3,280	3,429	458,606	2,814	438,125
24–Jul	42.70	88	3,812	3,900	462,506	2,521	440,646
25–Jul	42.54	41	3,982	4,023	466,529	2,333	442,979
26–Jul	42.58		4,142	4,142	470,671	1,717	444,696
27–Jul	42.58		3,920	3,920	474,591	1,579	446,276
28–Jul	42.43		3,452	3,452	478,043	1,916	448,192
29–Jul	42.38		3,476	3,476	481,519	1,683	449,875
30–Jul	42.31		2,423	2,423	483,942	1,588	451,464
31–Jul	42.33		1,920	1,920	485,862	1,388	452,851
01–Aug	42.48		1,438	1,438	487,300	1,354	454,205
02–Aug	42.81		1,098	1,098	488,398	1,100	455,305
Total		20,295	468,103	488,398			

a Meters above mean sea level.

b Permanent substrate was used from 3 June to end of project.

Table 2. Water levels at Miles Lake, elevation in meters above sea level, Miles Lake sonar, Copper River, 1982 – 1991.

	Elevation Above Sea Level										
Date	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1982–1991 Average
15–May						38.99		40.05			39.52
16–May								40.04			40.04
17–May						39.09		40.01			39.55
18–May					39.19	39.10		40.01			39.43
19–May					39.31	39.05	39.70	40.06			39.53
20–May			39.05		38.97	39.05	39.62	40.07			39.35
21–May			39.08		38.95	39.10	39.65	40.02	40.79	39.42	39.57
22–May			39.31		39.19	39.14	39.65	40.14	40.92	39.52	39.70
23–May			39.45		39.29	39.21	39.60	40.23	40.81	39.70	39.75
24–May		39.39	39.48		39.37	39.28	39.61	40.27	40.63	39.96	39.75
25–May		39.39	39.57		39.38	39.29	39.64	40.16	40.48	40.17	39.76
26–May		39.36	39.61		39.46	39.36	39.67	40.17	40.48	40.33	39.81
27–May		39.37	39.71		39.54	39.46	39.75	40.27	40.58	40.41	39.89
28–May		39.39	39.75	40.28	39.60	39.46	39.78	40.42	40.77	40.51	40.00
29–May		39.38	39.61	40.34	39.77	39.48	39.82	40.60	41.00	40.55	40.06
30–May	39.62	39.44	39.55	40.31	39.97	39.45	39.87	41.00	41.47	40.56	40.12
31–May		39.58	39.47	40.18	39.96	39.48	40.00	41.49	41.72	40.58	40.27
01–Jun		**39.94**	**39.46**	**40.03**	**39.97**	**39.76**	**40.12**	**41.82**	**41.00**	**40.51**	**40.29**
02–Jun	40.03	40.64	39.42	39.90	39.96	39.98	40.14	41.87	42.03	40.42	40.44
03–Jun	40.31	41.00	39.39	39.88	39.97	40.33	40.16	41.70	42.18	40.32	40.52
04–Jun	40.60	40.94	39.45	39.95	39.90	40.36	40.26	41.70	42.26	40.31	40.57
05–Jun	40.72	40.94	39.61	40.18	39.88	40.30	40.32	42.02	42.45	40.38	40.68
06–Jun	40.83	40.89	39.75	40.44	39.98	40.43	40.35	42.11	42.67	40.42	40.79
07–Jun	40.71	40.82	40.04	40.36	40.19	40.73	40.61	42.06	42.81	40.47	40.88
08–Jun	40.69	40.82	40.34	40.11	40.43	40.88	40.82	42.00	42.98	40.55	40.96
09–Jun		40.85	40.36	40.03	40.46	40.69	41.15	41.89	42.96	40.60	41.00
10–Jun	41.50	40.84	40.36	40.06	40.36	40.64	41.48	41.92	42.85	40.58	41.06
11–Jun		40.82	40.43	40.01	40.24	40.54	41.80	41.80	42.63	40.71	41.00
12–Jun		40.84	40.56	40.01	40.13	40.38	42.00	41.65	42.47	40.87	40.99
13–Jun		40.81	40.68	40.11	40.22	40.34	42.19	41.73	42.44	41.06	41.06
14–Jun		40.67	40.84	40.13	40.33	40.37	42.36	41.78	42.61	41.31	41.16
15–Jun	41.27	40.71	40.97	40.16	40.62	40.36	42.45	42.03	42.66	41.53	41.28
16–Jun		40.60	41.07	40.13	41.05	40.36	42.64	42.13	42.58	41.77	41.37
17–Jun	41.06	40.75	41.05	40.13	41.58	40.44	42.80	42.02	42.52	42.00	41.43
18–Jun	40.93	40.88	40.89	40.36	41.83	40.57	42.99	41.94	42.39	42.10	41.49
19–Jun		40.97	40.97	40.49	41.88	40.51	42.90	42.02	42.15	42.04	41.55
20–Jun	41.16	41.31	41.15	40.49	41.89	40.43	42.56	42.09	42.03	42.05	41.51
21–Jun	41.50	41.58	41.31	40.51	41.71	40.36	42.32	42.15	41.91	42.53	41.59
22–Jun	41.54	41.85	41.66	40.34	41.54	40.70	42.53	42.22	41.92	43.14	41.74
23–Jun		41.95	41.76	40.39	41.43	41.18	42.25	42.34	41.93	43.69	41.88
24–Jun	41.35	42.01	41.99	40.46	41.29	41.27	41.82	42.48	42.01	44.02	41.87
25–Jun		42.19	42.35	40.74	41.11	41.23	41.73	42.84	42.02	44.03	42.03
26–Jun	41.62	42.43	42.60	40.79	41.00	41.10	41.68	43.13	42.09	43.83	42.03
27–Jun		42.44	42.75	40.77	40.97	40.98	41.68	43.11	42.31	43.64	42.07
28–Jun	42.39	42.43	42.58	40.97	41.17	41.28	41.55	43.01	42.59	43.57	42.15
29–Jun		42.60	42.37	41.20	41.52	41.00	41.79	42.98	42.96	43.66	42.23
30–Jun	42.90	42.55	42.14	41.43	41.62	41.53	41.79	43.03	43.27	43.78	42.40

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Table 2. (page 2 of 2).

	Elevation Above Sea Level										
Date	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1982–1991 Average
01–Jul	42.81	42.43	41.88	41.86	41.96	42.37	41.73	43.10	43.49	43.87	42.55
02–Jul		42.24	41.94	42.32	42.37	42.83	41.82	43.31	43.78	43.90	42.72
03–Jul	42.57	42.33	41.91	42.55	42.61	42.85	41.99	43.49	43.76	43.77	42.78
04–Jul	42.18	42.51	41.91	42.62	42.70	42.91	42.29	43.41	43.71	43.76	42.80
05–Jul		42.60	41.96	42.62	42.85	43.04	42.51	43.43	43.71	43.53	42.92
06–Jul		42.67	41.86	42.67	43.03	43.16	42.66	43.38	43.74	43.24	42.93
07–Jul	41.92	42.70	42.06	42.85	43.11	43.12	42.95	43.42	43.85	43.07	42.90
08–Jul		42.84	42.29	42.93	43.13	42.93	43.08	43.43	43.75	43.08	43.05
09–Jul		42.81	42.52	42.75	43.03	42.33	43.06	43.50	43.51	43.22	42.97
10–Jul		42.82	42.72	42.55	42.70	42.52	42.94	43.63	43.14	43.49	42.95
11–Jul	42.72	42.72	42.62	42.52	42.62	42.49	42.72	43.74	42.81	43.22	42.82
12–Jul		42.55	42.47	42.55	42.76	42.50	42.53	43.95	42.58	43.04	42.77
13–Jul		42.14	42.32	42.62	42.80	42.53	42.72	44.07	42.51	42.94	42.74
14–Jul		41.98	42.19	42.60	42.78	42.41	42.73	44.03	42.42	42.92	42.67
15–Jul		41.80	42.16	42.55	42.51	42.47	42.66	43.82	42.37	42.85	42.58
16–Jul	42.44	41.95	42.06	42.44	42.35	42.43	42.64	43.51	42.28	42.82	42.49
17–Jul		42.10	41.96	42.42		42.47	42.72	43.20	42.12	42.96	42.49
18–Jul	42.35	42.23	41.83	42.49		42.35	43.03	43.14	42.50	42.86	42.53
19–Jul		42.46	41.96	42.49		42.36	43.18	43.30	42.78	42.50	42.63
20–Jul	42.39	42.55	41.99	42.60		42.63	43.18	43.47	43.06	42.17	42.67
21–Jul		42.53	41.76	42.90		42.78	43.24	43.58	43.28	42.11	42.77
22–Jul		42.48	41.63	42.88	43.53	43.36	43.53	43.32	43.57	42.27	42.95
23–Jul	42.09	42.27	41.61	42.62	43.41	43.51	43.40	43.14	43.62	42.41	42.81
24–Jul	42.58	42.30	41.66	42.37	43.34	43.39	43.38	43.00	43.72	42.70	42.84
25–Jul	42.72	42.30	41.86	42.24		43.17	43.04	42.91	43.83	42.87	42.77
26–Jul	42.98	42.20	42.06	42.24	42.77	43.01	42.70	42.86	43.75	42.97	42.75
27–Jul	43.13	42.10	42.19	41.99	42.45	43.02	42.54	42.81	43.25	42.95	42.64
28–Jul	43.09	42.23	42.29	41.99	42.22	43.16	42.58	42.75	42.90	42.90	42.61
29–Jul		42.51	42.29	42.11	42.01	43.23	42.58	42.87	43.15	42.82	42.62
30–Jul		42.68	42.39	42.24	41.94	43.29	42.43	42.96	43.46	42.77	42.69
31–Jul		42.76	42.34	42.39	41.98	43.26	42.38	43.13	43.51	42.65	42.71
01–Aug		42.79	42.39	42.55		43.07	42.31	43.29	43.51		42.84
02–Aug	43.90	42.66	42.32	42.98		42.98	42.33	43.37	43.51		43.01
03–Aug	43.84	42.61	42.34	44.35		42.92	42.48				43.09
04–Aug		42.55	42.34	45.09		42.93	42.81				43.14
05–Aug		42.62	42.42			42.88					42.64
06–Aug			42.42								42.42
07–Aug			42.42								42.42
08–Aug			42.42								42.42

Table 3. Daily sockeye salmon escapement estimates, Miles Lake sonar, 1989.

Date	Water Level [a]	Estimate				Escapement Objective	
		North Bank	South Bank	Daily	Cumulative	Daily	Cumulative
17-May	40.01		732	732	732	325	325
18-May	40.01		3,660	3,660	4,392	662	987
19-May	40.06		6,588	6,588	10,980	1,467	2,454
20-May	40.07	880	6,055	6,935	17,915	1,918	4,372
21-May	40.02	500	4,334	4,834	22,749	2,476	6,848
22-May	40.14	1,004	3,026	4,030	26,779	2,726	9,574
23-May	40.23	793	5,679	6,472	33,251	3,523	13,097
24-May	40.27	983	6,465	7,448	40,699	4,944	18,041
25-May	40.16	783	3,875	4,658	45,357	5,164	23,205
26-May	40.17	1,363	6,955	8,318	53,675	5,522	28,727
27-May	40.27	2,770	10,373	13,143	66,818	7,373	36,100
28-May	40.42	1,529	12,351	13,880	80,698	9,551	45,651
29-May	40.60	879	9,798	10,677	91,375	7,252	52,903
30-May	41.00	547	4,828	5,375	96,750	8,330	61,233
31-May	41.49	383	6,933 [b]	7,316	104,066	9,997	71,230
01-Jun	41.82	361	6,680	7,041	111,107	10,306	81,536
02-Jun	41.87	376	4,858	5,234	116,341	12,004	93,540
03-Jun	41.70	350	6,517	6,867	123,208	12,203	105,743
04-Jun	41.70	564	7,991	8,555	131,763	13,639	119,382
05-Jun	42.02	392	7,120	7,512	139,275	15,032	134,414
06-Jun	42.11	445	7,274	7,719	146,994	13,554	147,968
07-Jun	42.06	533	12,160	12,693	159,687	12,799	160,767
08-Jun	42.00	540	14,025	14,565	174,252	14,173	174,940
09-Jun	41.89	846	8,594	9,440	183,692	13,986	188,926
10-Jun	41.92	1,058	11,068	12,126	195,818	12,750	201,676
11-Jun	41.80	1,065	8,598	9,663	205,481	11,879	213,555
12-Jun	41.65	804	7,452	8,256	213,737	10,226	223,781
13-Jun	41.73	726	9,900	10,626	224,363	8,606	232,387
14-Jun	41.78	631	12,917	13,548	237,911	8,201	240,588
15-Jun	42.03	519	9,403	9,922	247,833	8,541	249,129
16-Jun	42.13	445	8,444	8,889	256,722	8,253	257,382
17-Jun	42.02	151	9,869	10,020	266,742	8,187	265,569
18-Jun	41.94	511	10,620	11,131	277,873	6,612	272,181
19-Jun	42.02	264	8,081	8,345	286,218	5,647	277,828
20-Jun	42.09	171	7,404	7,575	293,793	5,823	283,651
21-Jun	42.15	544	6,625	7,169	300,962	5,419	289,070
22-Jun	42.22	296	8,572	8,868	309,830	5,787	294,857
23-Jun	42.34	258	5,592	5,850	315,680	6,573	301,430
24-Jun	42.48	104	3,823	3,927	319,607	6,435	307,865
25-Jun	42.84	197	2,799	2,996	322,603	5,786	313,651
26-Jun	43.13	139	3,287	3,426	326,029	4,953	318,604
27-Jun	43.11	157	3,083	3,240	329,269	4,730	323,334
28-Jun	43.01	133	6,169	6,302	335,571	4,370	327,704
29-Jun	42.98	518	5,972	6,490	342,061	4,581	332,285
30-Jun	43.03	492	6,862	7,354	349,415	4,819	337,104

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Table 3. (page 2 of 2).

Date	Water Level [a]	Estimate				Escapement Objective	
		North Bank	South Bank	Daily	Cumulative	Daily	Cumulative
01–Jul	43.10	250	7,680	7,930	357,345	4,718	341,822
02–Jul	43.31	158	5,138	5,296	362,641	5,074	346,896
03–Jul	43.49	149	4,827	4,976	367,617	5,078	351,974
04–Jul	43.41	207	7,162	7,369	374,986	5,384	357,358
05–Jul	43.43	370	10,369	10,739	385,725	4,513	361,871
06–Jul	43.38	355	9,669	10,024	395,749	4,530	366,401
07–Jul	43.42	304	9,932	10,236	405,985	4,153	370,554
08–Jul	43.43	385	10,728	11,113	417,098	4,654	375,208
09–Jul	43.50	508	10,253	10,761	427,859	4,931	380,139
10–Jul	43.63	465	9,041	9,506	437,365	5,806	385,945
11–Jul	43.74	290	8,163	8,453	445,818	5,179	391,124
12–Jul	43.95	367	11,586	11,953	457,771	5,374	396,498
13–Jul	44.07	245	9,084	9,329	467,100	4,884	401,382
14–Jul	44.03	395	9,875	10,270	477,370	4,842	406,224
15–Jul	43.82	125	12,158	12,283	489,653	5,493	411,717
16–Jul	43.51	220	10,677	10,897	500,550	6,053	417,770
17–Jul	43.20	224	8,679	8,903	509,453	5,448	423,218
18–Jul	43.14	401	11,410	11,811	521,264	6,534	429,752
19–Jul	43.30	725	9,842	10,567	531,831	7,222	436,974
20–Jul	43.47	501	9,668	10,169	542,000	6,649	443,623
21–Jul	43.58	596	8,043	8,639	550,639	5,098	448,721
22–Jul	43.32		8,908	8,908	559,547	4,706	453,427
23–Jul	43.14		8,103	8,103	567,650	3,646	457,073
24–Jul	43.00		6,250	6,250	573,900	3,332	460,405
25–Jul	42.91		5,303	5,303	579,203	3,354	463,759
26–Jul	42.86		5,706	5,706	584,909	2,838	466,597
27–Jul	42.81		5,699	5,699	590,608	2,010	468,607
28–Jul	42.75		4,926	4,926	595,534	2,168	470,775
29–Jul	42.87		4,150	4,150	599,684	2,101	472,876
30–Jul	42.96		2,519	2,519	602,203	1,899	474,775
31–Jul	43.13		1,551	1,551	603,754	1,664	476,439
01–Aug	43.29		2,299	2,299	606,053	1,645	478,084
02–Aug	43.37		1,744	1,744	607,797	1,341	479,425
Total		33,244	574,553	607,797			

a Meters above mean sea level.

b Permanent substrate was used from 31 May to the end of project.

Table 4. Daily sockeye salmon escapement estimates, Miles Lake sonar, 1990.

Date	Water Level [a]	Estimate				Escapement Objective		0700	Anticip. Daily
		North Bank	South Bank	Daily	Cumulative	Daily	Cumulative		
21–May	40.79		1,121 [b]	1,121	1,121	3,101	8,394		
22–May	40.92	809	4,034	4,843	5,964	3,468	11,862		
23–May	40.81	1,050	6,127	7,177	13,141	4,216	16,078	2976	10,203
24–May	40.63	773	11,150	11,923	25,064	5,468	21,546	3,252	11,150
25–May	40.48	524	13,809	14,333	39,397	5,892	27,438	3,967	13,601
26–May	40.48	1,630	9,707	11,337	50,734	7,237	34,675	3,307	11,338
27–May	40.58	1,378	10,682	12,060	62,794	9,078	43,753	2,827	9,693
28–May	40.77	1,325	6,109	7,434	70,228	11,220	54,973	3,055	10,474
29–May	41.00	1,250	7,926	9,176	79,404	9,508	64,481	2,927	10,035
30–May	41.47	1,184	8,357	9,541	88,945	9,910	74,391	2,595	8,897
31–May	41.72	1,324	9,019	10,343	99,288	10,551	84,942	3,112	10,670
01–Jun	41.00	406	9,620	10,026	109,314	10,901	95,843	2,779	9,528
02–Jun	42.03	436	9,473	9,909	119,223	12,683	108,526	2,483	8,513
03–Jun	42.18	383	8,193	8,576	127,799	12,343	120,869	2,636	9,038
04–Jun	42.26	685	6,887	7,572	135,371	13,402	134,271	2,529	8,671
05–Jun	42.45	1,086	9,087	10,173	145,544	14,683	148,954	2,594	8,894
06–Jun	42.67	907	9,503	10,410	155,954	13,175	162,129	2,381	8,163
07–Jun	42.81	1,336	9,801	11,137	167,091	12,501	174,630	2,823	9,679
08–Jun	42.98	1,076	6,561	7,637	174,728	13,934	188,564	1,777	6,093
09–Jun	42.96	1,350	8,555	9,905	184,633	13,443	202,007	2,556	8,763
10–Jun	42.85	916	10,744	11,660	196,293	12,241	214,248	2,332	7,995
11–Jun	42.63	1,242	14,939	16,181	212,474	11,276	225,524	4,748	16,279
12–Jun	42.47	1,839	22,090	23,929	236,403	9,807	235,331	4,936	16,923
13–Jun	42.44	1,533	22,915	24,448	260,851	8,482	243,813	6,383	21,885
14–Jun	42.61	751	13,551	14,302	275,153	8,362	252,175	5,131	17,592
15–Jun	42.66	593	7,797	8,390	283,543	8,583	260,758	2,405	8,246
16–Jun	42.58	1,129	8,983	10,112	293,655	8,158	268,916	1,975	6,771
17–Jun	42.52	655	12,040	12,695	306,350	8,043	276,959	2,893	9,919
18–Jun	42.39	695	7,357	8,052	314,402	6,643	283,602	2,217	7,601
19–Jun	42.15	994	8,769	9,763	324,165	5,603	289,205	2,158	7,399
20–Jun	42.03	1,232	8,083	9,315	333,480	5,601	294,806	2,382	8,167
21–Jun	41.91	971	9,321	10,292	343,772	5,279	300,085	3,114	10,677
22–Jun	41.92	602	9,555	10,157	353,929	5,713	305,798	2,541	8,712
23–Jun	41.93	648	9,518	10,166	364,095	6,348	312,146	2,946	10,101
24–Jun	42.01	438	8,902	9,340	373,435	6,109	318,255	2,676	9,175
25–Jun	42.02	282	9,728	10,010	383,445	5,598	323,853	2,601	8,918
26–Jun	42.09	486	6,326	6,812	390,257	5,113	328,966	2,344	8,037
27–Jun	42.31	492	8,742	9,234	399,491	4,896	333,862	2,559	8,774
28–Jun	42.59	528	6,353	6,881	406,372	4,592	338,454	1,991	6,826
29–Jun	42.96	475	4,024	4,499	410,871	4,801	343,255	1,469	5,037
30–Jun	43.27	401	3,574	3,975	414,846	5,245	348,500	700	2,400

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Table 4. (page 2 of 2)

Date	Water Level [a]	Estimate North Bank	Estimate South Bank	Estimate Daily	Estimate Cumulative	Escapement Objective Daily	Escapement Objective Cumulative	0700	Anticip. Daily
01–Jul	43.49	365	3,958	4,323	419,169	4,995	353,495	860	2,949
02–Jul	43.78	244	4,823	5,067	424,236	5,089	358,584	1,231	4,221
03–Jul	43.76	240	4,442	4,682	428,918	5,458	364,042	1,494	5,122
04–Jul	43.71	286	5,379	5,665	434,583	5,893	369,935	1,319	4,522
05–Jul	43.71	450	7,548	7,998	442,581	5,097	375,032	2,319	7,951
06–Jul	43.74	435	7,314	7,749	450,330	4,916	379,948	2,362	8,098
07–Jul	43.85	322	5,378	5,700	456,030	4,696	384,644	1,931	6,621
08–Jul	43.75	312	4,880	5,192	461,222	4,757	389,401	1,142	3,915
09–Jul	43.51	307	4,846	5,153	466,375	4,798	394,199	1,095	3,754
10–Jul	43.14	272	6,348	6,620	472,995	5,951	400,150	1,520	5,211
11–Jul	42.81	648	4,754	5,402	478,397	5,486	405,636	1,258	4,313
12–Jul	42.58	520	8,818	9,338	487,735	5,770	411,406	2,319	7,951
13–Jul	42.51	878	10,554	11,432	499,167	5,142	416,548	2,758	9,456
14–Jul	42.42	553	7,653	8,206	507,373	5,342	421,890	2,394	8,208
15–Jul	42.37	323	7,986	8,309	515,682	5,322	427,212	1,822	6,247
16–Jul	42.28	1,066	5,027	6,093	521,775	5,517	432,729	1,856	6,363
17–Jul	42.12	575	5,684	6,259	528,034	5,452	438,181	1,611	5,523
18–Jul	42.50	585	5,141	5,726	533,760	6,513	444,694	1,350	4,629
19–Jul	42.78	609	5,366	5,975	539,735	6,948	451,642	1,502	5,150
20–Jul	43.06	374	3,941	4,315	544,050	6,591	458,233	891	3,055
21–Jul	43.28	236	2,298	2,534	546,584	5,321	463,554	1,101	3,775
22–Jul	43.57	106	2,351	2,457	549,041	4,239	467,793	534	1,831
23–Jul	43.62	328	3,573	3,901	552,942	3,422	471,215	1,430	4,903
24–Jul	43.72	300	2,583	2,883	555,825	3,351	474,566	558	1,913
25–Jul	43.83	293	1,757	2,050	557,875	3,321	477,887	743	2,547
26–Jul	43.75	132	2,125	2,257	560,132	2,812	480,699	694	2,379
27–Jul	43.25	384	2,501	2,885	563,017	2,319	483,018	680	2,331
28–Jul	42.90		1,934	1,934	564,951	2,445	485,463	448	1,536
29–Jul	43.15		2,808	2,808	567,759	2,104	487,567	725	2,486
30–Jul	43.46		2,462	2,462	570,221	1,840	489,407	469	1,608
31–Jul	43.51		2,550	2,550	572,771	1,568	490,975	557	1,910
01–Aug	43.51		3,839	3,839	576,610	1,562	492,537	570	1,954
02–Aug	43.51		5,249	5,249	581,859	1,264	493,801	1,531	5,249
Total		46,957	534,902	581,859					

a Feet above mean sea level.

b Permanent substrate used from 21 May to project end.

Table 5. Daily sockeye salmon escapement estimates, Miles Lake sonar, 1991.

Date	Water Level [a]	Estimate North Bank	Estimate South Bank	Estimate Daily	Estimate Cumulative	Escapement Objective Daily	Escapement Objective Cumulative	Anticipated 0700	Anticipated Daily
21–May	39.42		1,087	1,087	1,087	2,458	10,263		
22–May	39.52		1,717	1,717	2,804	2,938	13,201		
23–May	39.70	310	2,851	3,161	5,965	3,868	17,069	446	1,529
24–May	39.96	184	2,281	2,465	8,430	5,344	22,413	629	2,157
25–May	40.17	230	2,816	3,046	11,476	6,184	28,597	665	2,280
26–May	40.33	236	3,038	3,274	14,750	7,610	36,207	923	3,165
27–May	40.41	223	3,670	3,893	18,643	9,246	45,453	1,198	4,107
28–May	40.51	109	3,280	3,389	22,032	10,509	55,962	814	2,791
29–May	40.55	372	3,561	3,933	25,965	8,884	64,846	1,032	3,538
30–May	40.56	481	3,936	4,417	30,382	9,647	74,493	716	2,455
31–May	40.58	541	8,821	9,362	39,744	10,304	84,797	1,736	5,952
01–Jun	40.51	950	15,883	16,833	56,577	10,414	95,211	4,310	14,777
02–Jun	40.42	757	20,394	21,151	77,728	11,750	106,961	5,135	17,606
03–Jun	40.32	586	17,222	17,808	95,536	11,169	118,130	4,201	14,403
04–Jun	40.31	961	13,596	14,557	110,093	12,128	130,258	5,080	17,417
05–Jun	40.38	527	18,146	18,673	128,766	13,720	143,978	4,795	16,440
06–Jun	40.42	786	10,902	11,688	140,454	13,096	157,074	3,489	11,962
07–Jun	40.47	122	8,318	8,440	148,894	12,563	169,637	1,864	6,391
08–Jun	40.55	162	9,309	9,471	158,365	13,484	183,121	2,582	8,853
09–Jun	40.60	219	11,446	11,665	170,030	12,885	196,006	2,799	9,597
10–Jun	40.58	227	8,338	8,565	178,595	11,739	207,745	3,256	11,163
11–Jun	40.71	120	7,984 [b]	8,104	186,699	10,923	218,668	1,207	4,138
12–Jun	40.87	77	12,611	12,688	199,387	10,100	228,768	3,513	12,045
13–Jun	41.06	195	8,871	9,066	208,453	9,218	237,986	3,764	12,905
14–Jun	41.31	158	9,078	9,236	217,689	8,558	246,544	2,428	8,325
15–Jun	41.53	132	14,835	14,967	232,656	8,388	254,932	3,870	13,269
16–Jun	41.77	126	14,241	14,367	247,023	8,096	263,028	4,248	14,565
17–Jun	42.00	34	10,095	10,129	257,152	8,057	271,085	2,406	8,249
18–Jun	42.10	24	11,027	11,051	268,203	6,404	277,489	3,058	10,485
19–Jun	42.04	192	12,729	12,921	281,124	5,685	283,174	2,947	10,104
20–Jun	42.05	338	13,808	14,146	295,270	5,828	289,002	4,701	16,118
21–Jun	42.53	144	8,606	8,750	304,020	5,534	294,536	2,590	8,880
22–Jun	43.14	142	7,688	7,830	311,850	5,936	300,472	2,241	7,683
23–Jun	43.69	193	6,165	6,358	318,208	6,660	307,132	1,943	6,662
24–Jun	44.02	301	5,662	5,963	324,171	6,424	313,556	1,576	5,403
25–Jun	44.03	366	7,294	7,660	331,831	5,881	319,437	2,383	8,170
26–Jun	43.83	187	9,313	9,500	341,331	5,376	324,813	2,741	9,398
27–Jun	43.64	61	10,294	10,355	351,686	5,403	330,216	2,336	8,009
28–Jun	43.57	163	10,647	10,810	362,496	4,972	335,188	3,644	12,494
29–Jun	43.66	90	10,349	10,439	372,935	5,028	340,216	2,793	9,576
30–Jun	43.78	95	9,018	9,113	382,048	5,433	345,649	2,654	9,099

–Continued–

Table 5. (page 2 of 2).

Date	Water Level [a]	Estimate North Bank	Estimate South Bank	Estimate Daily	Estimate Cumulative	Escapement Objective Daily	Escapement Objective Cumulative	Anticipated 0700	Anticipated Daily
01–Jul	43.87	120	7,183	7,303	389,351	5,132	350,781	2,807	9,624
02–Jul	43.90	139	4,970	5,109	394,460	5,239	356,020	1,583	5,427
03–Jul	43.77	129	6,206	6,335	400,795	5,705	361,725	1,677	5,750
04–Jul	43.76	156	6,524	6,680	407,475	6,157	367,882	1,610	5,520
05–Jul	43.53	135	5,710	5,845	413,320	5,583	373,465	1,837	6,298
06–Jul	43.24	78 [c]	6,135	6,213	419,533	5,469	378,934	2,023	6,936
07–Jul	43.07	178	6,044	6,222	425,755	5,051	383,985	1,121	3,843
08–Jul	43.08	203	6,866	7,069	432,824	5,014	388,999	1,703	5,839
09–Jul	43.22	185	6,268	6,453	439,277	5,066	394,065	1,796	6,158
10–Jul	43.49	132	4,478	4,610	443,887	6,240	400,305	1,195	4,097
11–Jul	43.22	128	4,349	4,477	448,364	5,974	406,279	1,192	4,087
12–Jul	43.04	138	4,680	4,818	453,182	6,733	413,012	1,376	4,718
13–Jul	42.94	114	3,855	3,969	457,151	6,281	419,293	1,187	4,070
14–Jul	42.92	215	7,283	7,498	464,649	6,202	425,495	1,394	4,779
15–Jul	42.85	216	7,334	7,550	472,199	6,216	431,711	1,825	6,257
16–Jul	42.82	277	9,394	9,671	481,870	6,040	437,751	3,686	12,638
17–Jul	42.96	277	9,391	9,668	491,538	5,875	443,626	2,894	9,922
18–Jul	42.86	210	7,130	7,340	498,878	7,103	450,729	2,439	8,362
19–Jul	42.50	215	7,298	7,513	506,391	7,763	458,492	1,706	5,849
20–Jul	42.17	306	10,375	10,681	517,072	7,316	465,808	3,143	10,776
21–Jul	42.11	294	9,974	10,268	527,340	6,093	471,901	3,370	11,554
22–Jul	42.27	278	9,424	9,702	537,042	5,068	476,969	2,975	10,200
23–Jul	42.41	258	8,759	9,017	546,059	3,985	480,954	2,346	8,043
24–Jul	42.70	122	4,123	4,245	550,304	3,829	484,783	992	3,401
25–Jul	42.87	88	2,978	3,066	553,370	3,823	488,606	678	2,325
26–Jul	42.97	127	4,295	4,422	557,792	3,476	492,082	894	3,065
27–Jul	42.95	111	3,773	3,884	561,676	2,917	494,999	893	3,062
28–Jul	42.90	137	4,656	4,793	566,469	2,896	497,895	1,054	3,614
29–Jul	42.82	153	5,201	5,354	571,823	2,385	500,280	975	3,343
30–Jul	42.77	135	4,576	4,711	576,534	1,967	502,247	1,015	3,480
31–Jul	42.65	83	2,818 [d]	2,901	579,435	1,610	503,857	918	3,147
Total		16,458	562,977	579,435					

a Meters above mean sea level.

b Permanent substrate was used from 11 June to end of project.

c North bank pulled 12:00 noon. All counts after 12:00 noon July 6 are interpelated. North bar counts are derived from the average percent of North versus south bank counts of 2.93 perce

d South bank pulled 12:00 noon. Numbers were expanded for a daily total.

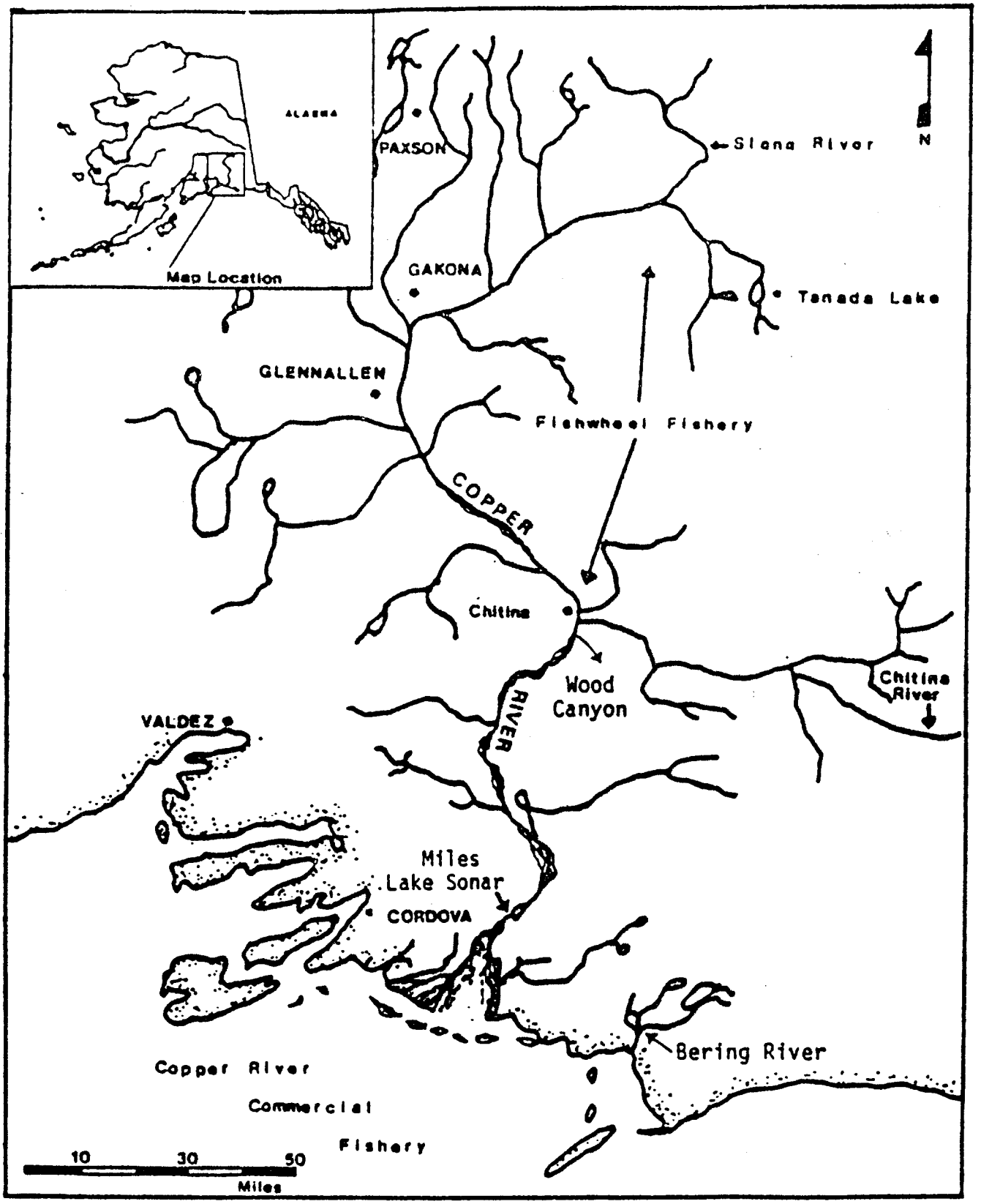


Figure 1. Commercial and subsistence fishing areas, Copper River drainage.

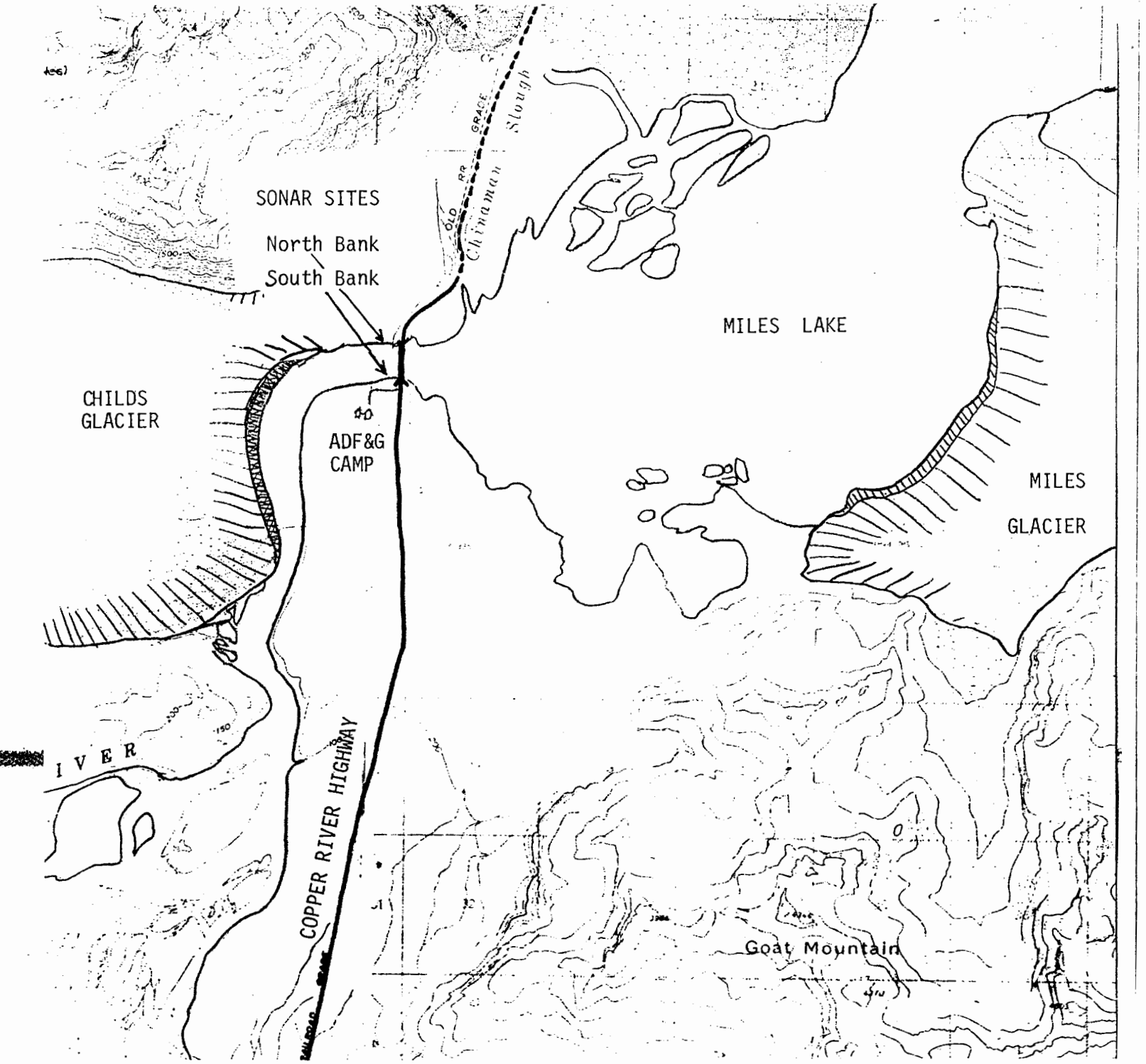


Figure 2. North and south bank sonar sites, Miles Lake area, Copper River.

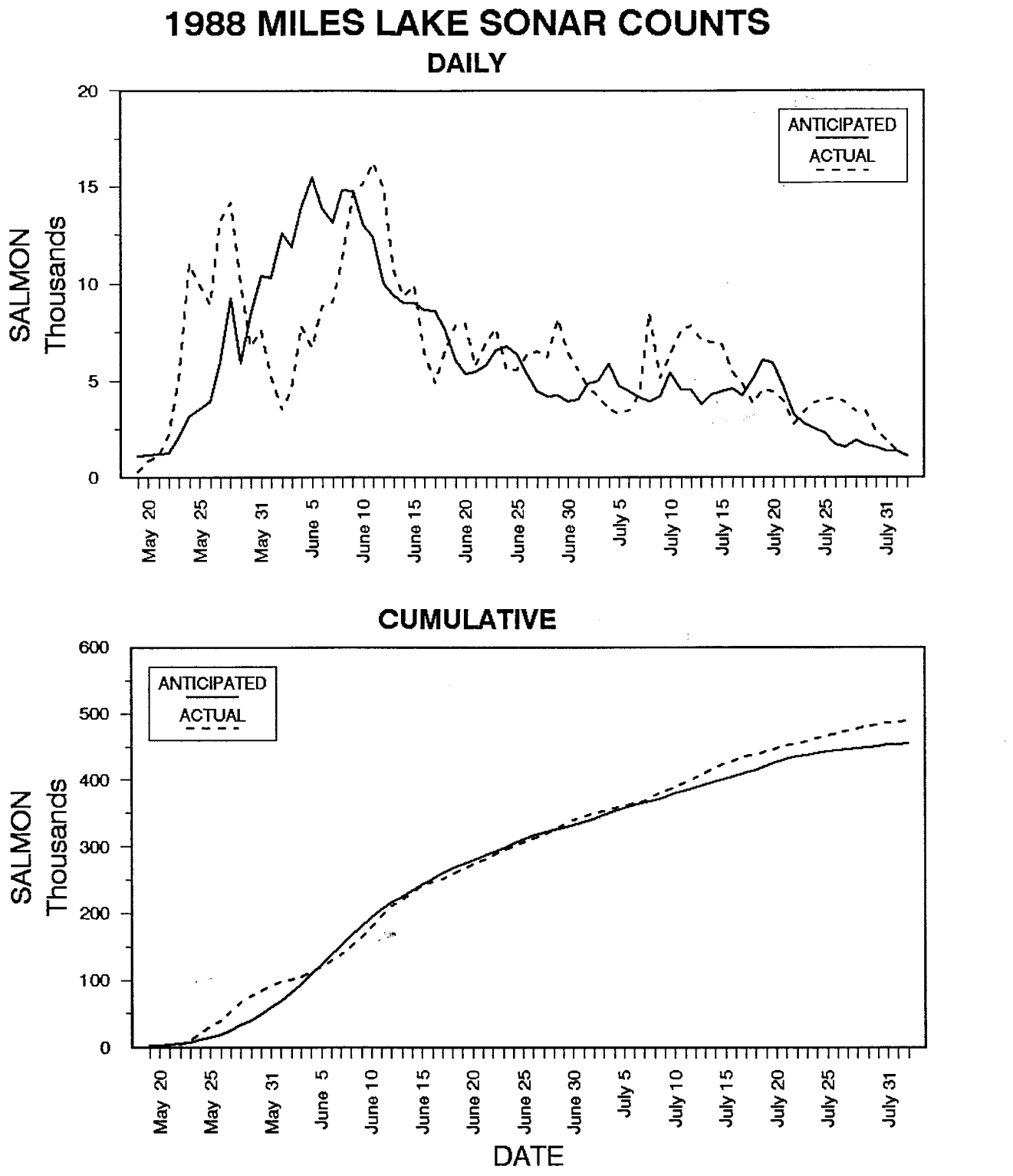


Figure 3. **Anticipated and actual daily and cumulative salmon escapement estimates, Miles Lake sonar, 1988.**

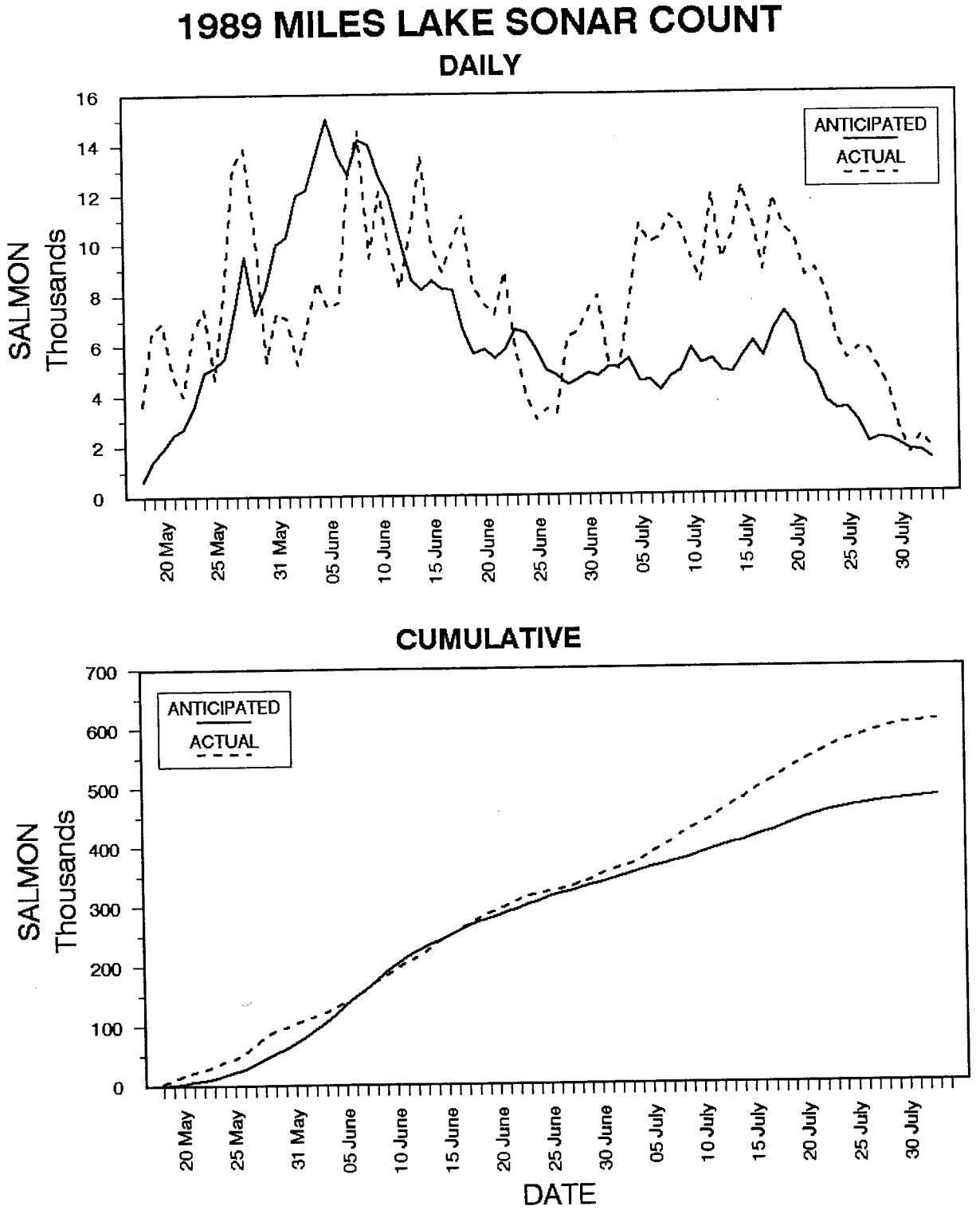


Figure 4. Anticipated and actual daily and cumulative salmon escapement estimates, Miles Lake sonar, 1989.

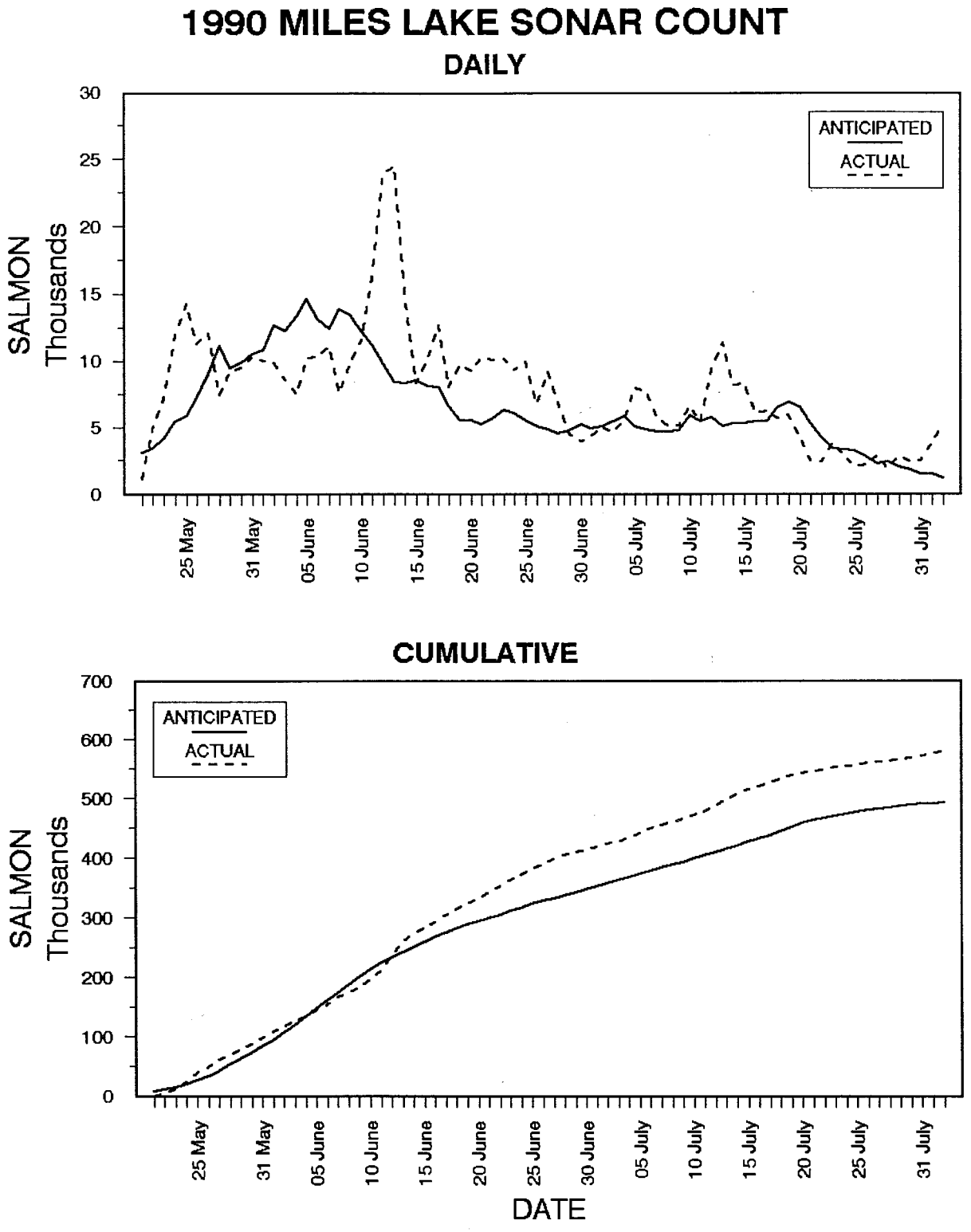


Figure 5. Anticipated and actual daily and cumulative salmon escapement estimates, Miles Lake sonar, 1990.

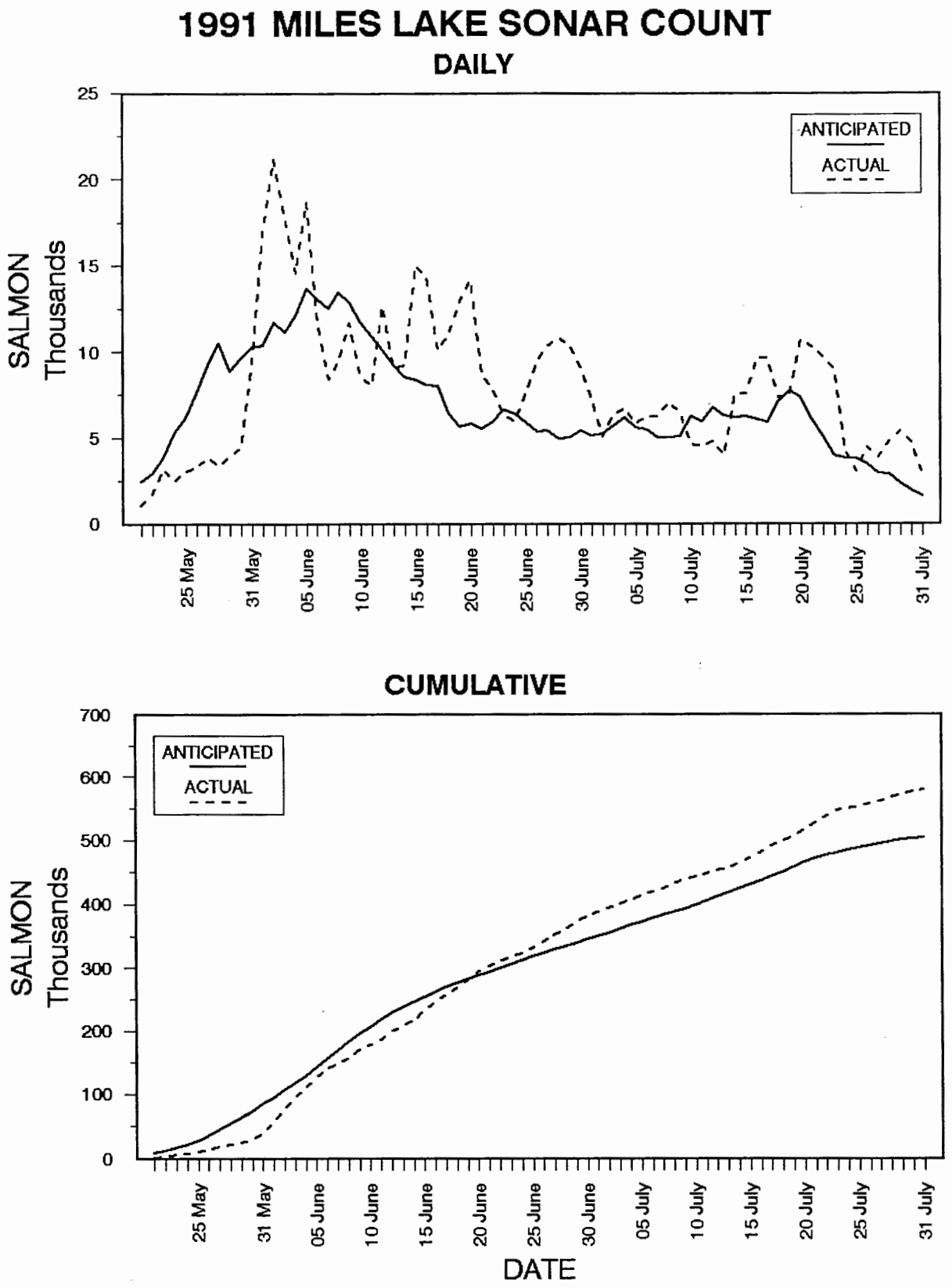
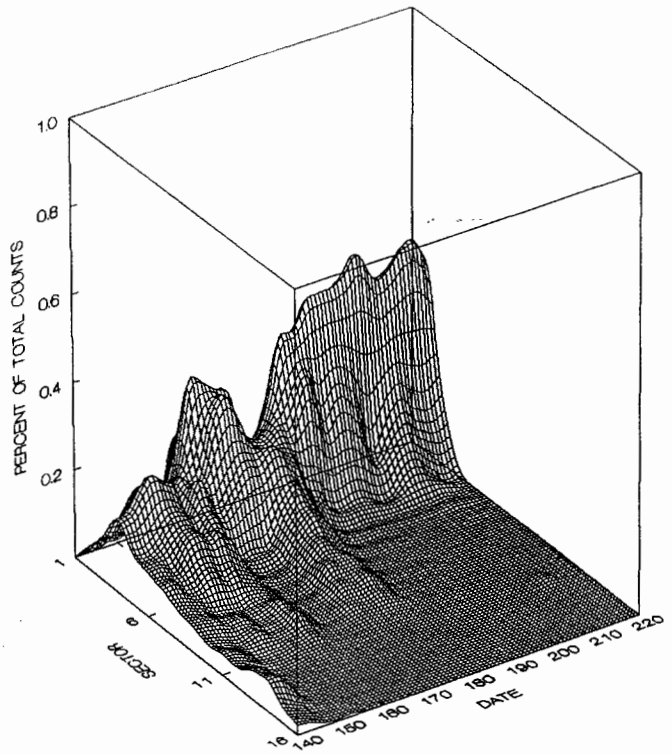


Figure 6. Anticipated and actual daily and cumulative salmon escapement estimates, Miles Lake sonar, 1991.



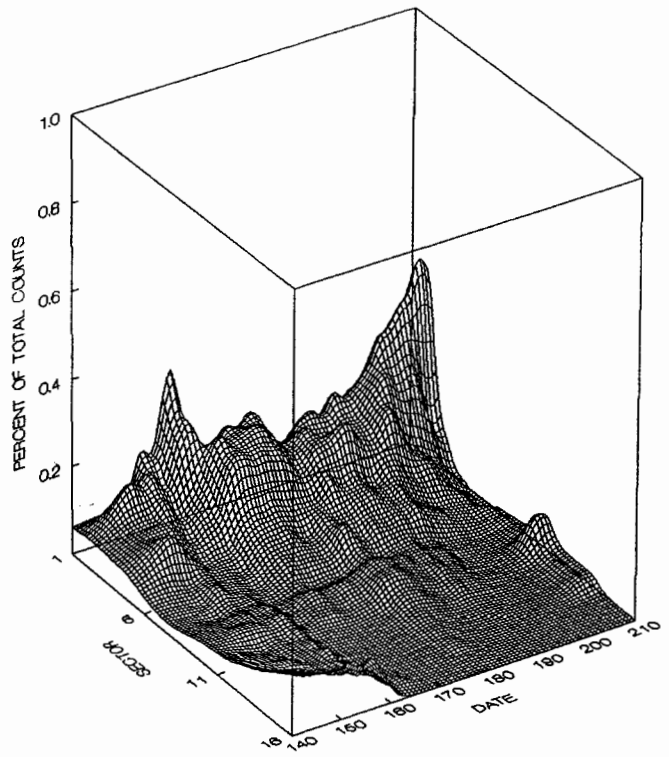
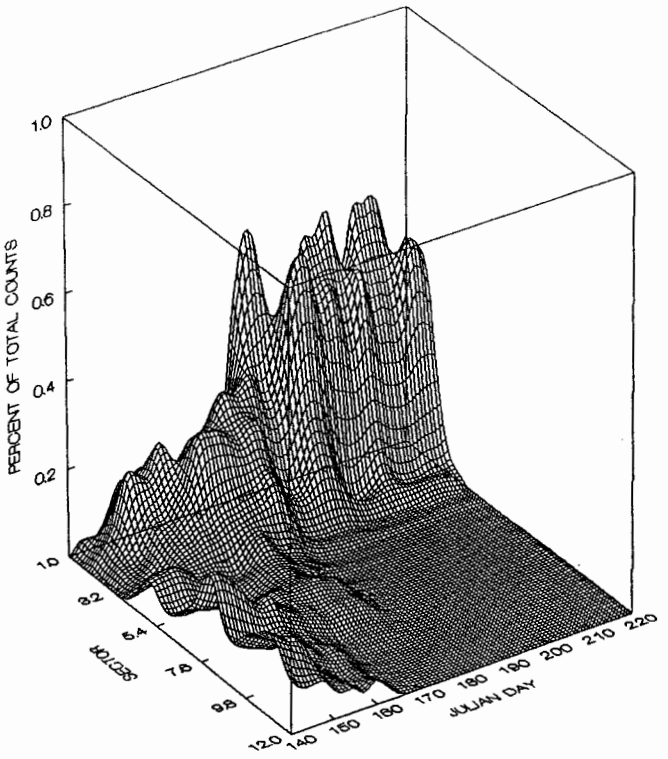


Figure 7. Mean sector count percentages for south and north bank counting units through time, Miles Lake sonar project, 1988.



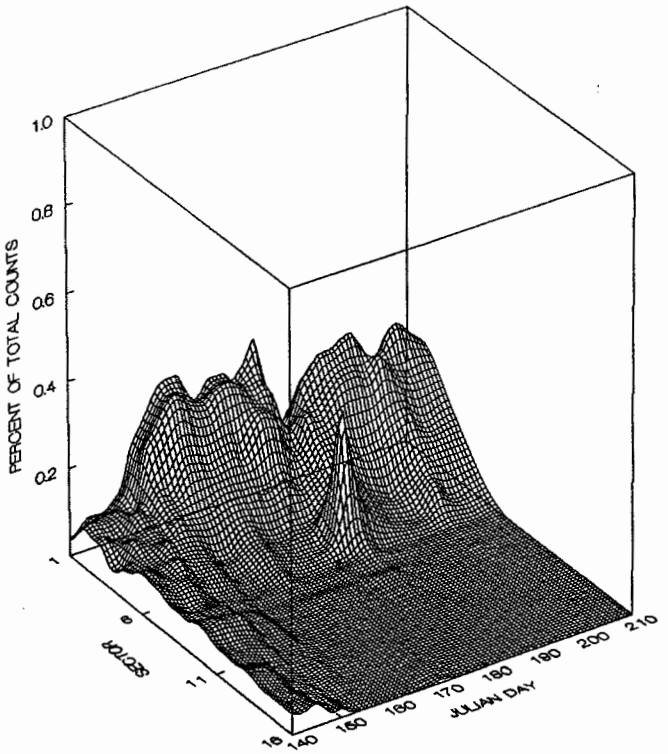
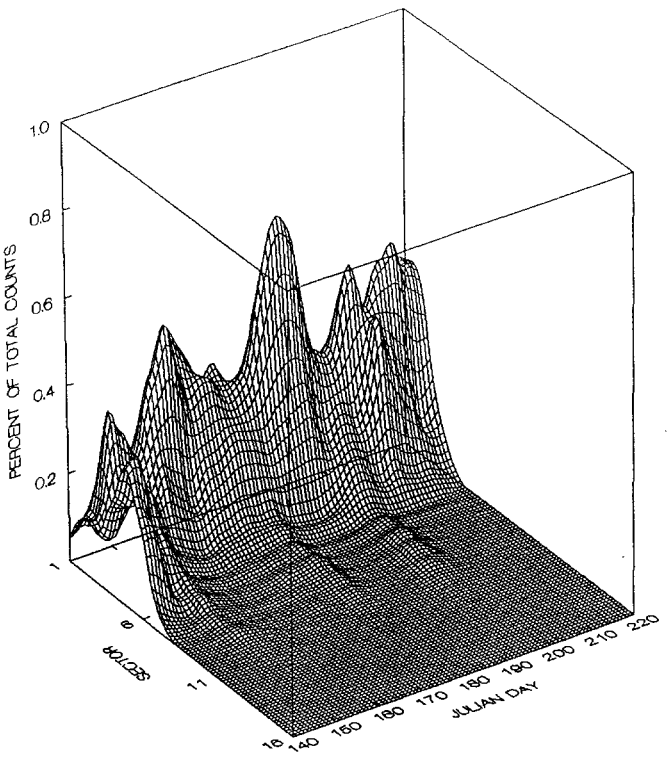


Figure 8. Mean sector count percentages for south and north bank counting units through time, Miles Lake sonar project, 1989.



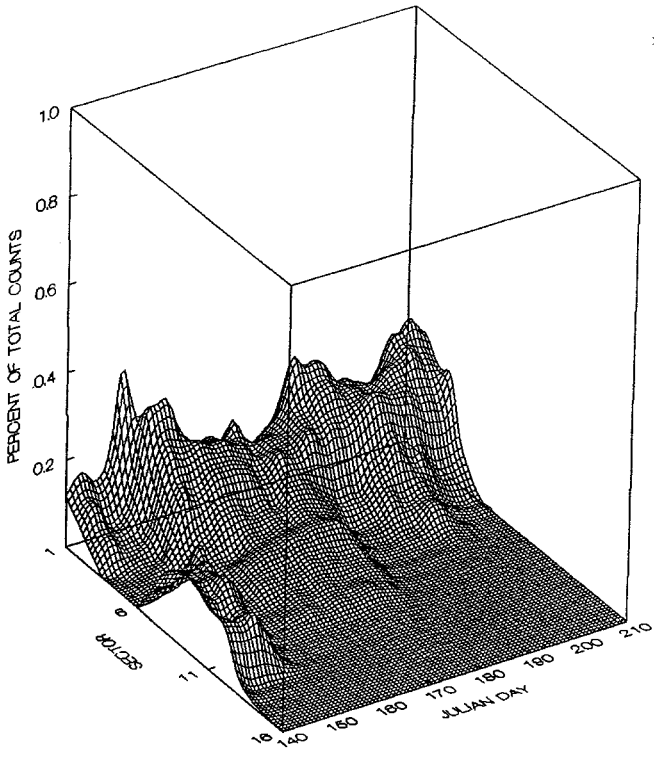
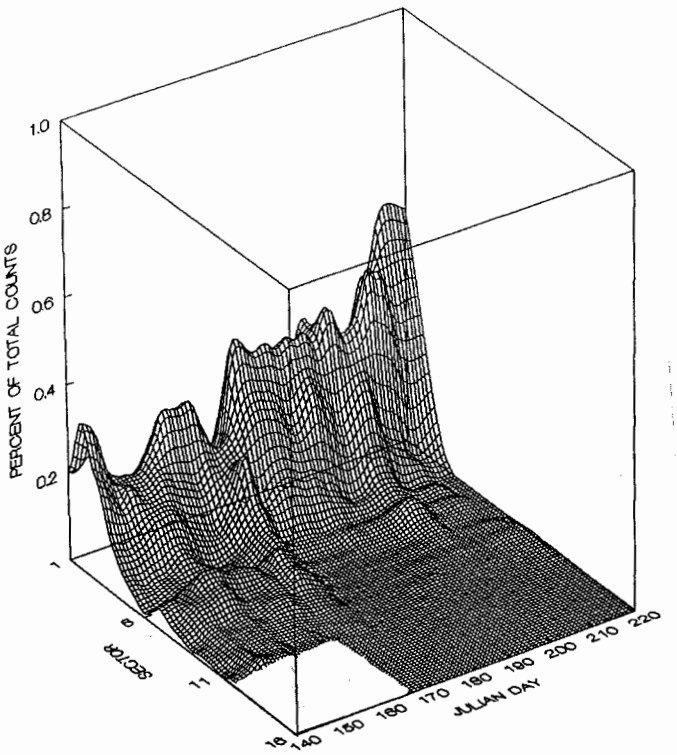


Figure 9. Mean sector count percentages for south and north bank counting units through time, Miles Lake sonar project, 1990.



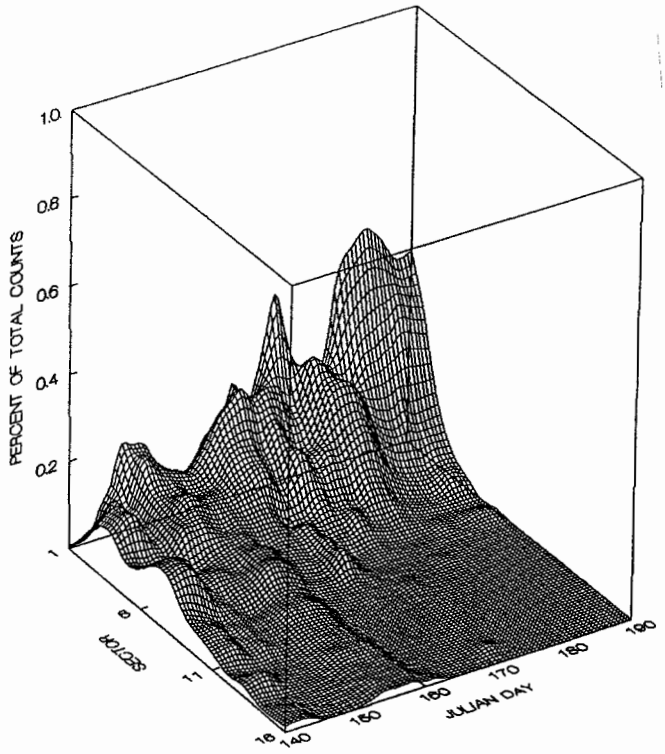


Figure 10. Mean sector count percentages for south and north bank counting units through time. Note the 12 sector counter operated the first 26 days, Miles Lake sonar project, 1991.

APPENDICES

Appendix 1. Daily salmon escapement estimates, Miles Lake sonar, Copper River, 1978–1991.

Date	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Average Daily Count	S.D.	C.V.
17–May				5,372								732			2,035	2,379	116.91
18–May		381	218	9,665								3,660			3,481	3,825	109.89
19–May		487	167	11,409			725				313	6,588			3,282	4,279	130.39
20–May		847	221	10,733			1,924			167	877	6,935			3,101	3,803	122.67
21–May		1,199	88	9,729			1,986			36	1,140	4,834	1,121	1,087	2,358	2,927	124.15
22–May		1,916	391	7,558			5,124			482	2,256	4,030	4,843	1,717	3,146	2,263	71.91
23–May		2,901	594	6,214		3,310	5,042			1,732	5,078	6,472	7,177	3,161	4,168	2,054	49.29
24–May		3,402	494	12,965	90	8,620	4,488			2,040	11,033	7,448	11,923	2,465	5,908	4,478	75.79
25–May		2,397	713	12,816	493	11,587	3,120		534	4,263	9,979	4,656	14,333	3,046	5,662	4,870	86.01
26–May	502	4,927	1,057	6,383	1,023	10,575	4,845		1,694	7,115	8,946	8,318	11,337	3,893	5,417	3,572	65.94
27–May	837	6,821	2,115	2,842	12,091	8,661	5,836		2,092	12,176	13,247	13,143	12,060	3,389	7,332	4,591	62.63
28–May	1,047	2,768	1,693	2,560	47,303	8,456	4,978	1,031	3,384	16,392	14,201	13,880	7,434	3,933	9,219	11,676	126.66
29–May	661	3,905	1,080	2,160	19,671	6,380	7,126	417	2,393	14,485	10,022	10,677	9,176	4,417	8,612	5,488	83.01
30–May	3,241	7,482	1,903	11,822	8,781	8,296	4,951	599	3,173	18,196	6,806	5,375	9,541	9,362	7,109	4,377	61.56
31–May	2,549	8,655	3,620	21,126	11,389	17,129	4,278	1,756	4,150	16,540	7,586	7,318	10,343	16,833	9,662	6,214	64.31
01–Jun	2,616	4,078	5,257	18,415	15,385	18,428	8,536	3,462	7,001	16,395	5,205	7,041	10,026	17,808	9,975	5,797	58.11
02–Jun	2,811	3,465	7,061	23,771	17,213	14,414	8,483	6,726	20,638	14,385	3,558	5,234	9,909	14,557	10,873	6,458	59.39
03–Jun	1,837	3,536	7,437	16,716	13,383	13,137	9,730	10,691	20,237	17,666	4,626	6,867	8,576	18,673	10,937	5,664	51.79
04–Jun	3,256	2,778	8,996	9,755	12,355	15,357	12,496	24,272	26,626	14,632	7,877	8,555	7,572	11,688	11,873	6,585	55.46
05–Jun	2,970	4,352	9,746	10,478	14,808	19,110	16,728	30,507	27,934	10,962	6,755	7,512	10,173	8,440	12,891	7,920	61.44
06–Jun	3,318	6,453	5,407	11,975	15,585	14,069	18,097	32,953	14,527	4,322	6,895	7,719	10,410	11,665	11,814	7,262	61.47
07–Jun	3,808	7,031	2,093	13,585	12,506	19,309	18,515	27,256	9,858	5,755	9,096	12,693	11,137	8,565	11,501	6,457	56.15
08–Jun	3,275	11,078	1,349	14,412	8,430	16,094	26,619	30,925	24,938	6,366	11,322	14,565	7,637	9,471	13,320	8,472	63.60
09–Jun	2,252	7,985	3,543	15,694	7,017	11,415	20,476	29,702	28,242	7,922	14,641	9,440	9,905	11,665	12,850	7,996	62.22
10–Jun	3,475	5,205	7,301	12,656	7,599	8,009	19,275	12,010	29,952	11,553	15,216	12,126	11,660	8,565	11,772	6,403	54.39
11–Jun	2,490	4,426	12,032	7,877	7,879	9,563	17,237	11,826	25,418	11,194	16,255	9,663	16,161	12,688	11,766	5,585	47.46
12–Jun	2,082	2,227	11,584	4,844	8,587	13,292	21,706	8,231	16,494	6,506	14,959	8,256	23,929	9,066	10,840	6,393	58.96
13–Jun	2,419	3,903	7,600	3,556	9,932	13,444	12,072	6,829	11,453	4,053	10,751	10,626	24,448	9,236	9,309	5,406	58.08
14–Jun	2,835	2,563	5,661	5,228	12,551	13,631	5,981	6,800	11,393	8,053	9,382	13,548	14,302	14,967	9,078	4,190	46.16
15–Jun	2,913	3,351	7,308	7,071	12,677	15,915	10,291	8,825	8,747	5,485	9,810	9,922	8,390	14,967	8,984	3,671	40.86
16–Jun	2,762	3,473	5,655	6,885	13,595	7,938	13,930	9,347	10,099	5,516	6,484	8,889	10,112	14,367	8,505	3,564	41.91
17–Jun	2,779	4,640	7,189	6,467	12,030	5,671	19,809	8,270	8,772	5,406	4,910	10,020	12,695	10,129	8,342	4,239	50.81
18–Jun	2,261	3,911	6,741	4,565	6,544	5,689	12,850	3,738	9,050	4,815	6,469	11,131	8,052	11,051	6,919	3,030	43.79
19–Jun	3,035	3,413	2,391	2,985	4,369	6,461	7,474	3,251	7,910	3,983	7,855	8,345	9,763	12,921	6,011	3,035	50.48
20–Jun	3,035	1,954	3,597	2,691	3,352	7,382	9,258	2,423	7,240	3,933	7,952	7,575	9,315	14,146	6,004	3,406	56.73
21–Jun	2,515	2,223	4,142	3,446	3,346	8,124	7,159	2,061	6,741	3,924	5,770	7,169	10,292	8,750	5,404	2,565	47.46
22–Jun	2,068	2,585	3,954	3,997	4,467	8,005	5,522	2,763	9,026	6,379	6,985	8,868	10,157	7,830	5,900	2,555	43.30
23–Jun	2,841	2,865	3,896	4,363	7,031	7,528	5,913	3,369	8,010	10,111	7,699	5,850	10,166	6,358	6,143	2,365	38.50
24–Jun	2,618	1,877	5,217	4,651	6,329	6,009	6,741	2,950	6,968	15,706	5,582	3,927	9,340	5,963	5,991	3,291	54.93
25–Jun	2,130	3,013	5,104	3,398	4,903	5,226	6,503	1,585	5,731	16,517	5,597	2,996	10,010	7,680	5,741	3,692	64.30
26–Jun	1,771	1,973	3,595	2,412	4,416	5,638	4,385	2,381	5,410	12,500	6,378	3,426	6,812	9,500	5,043	2,934	58.19
27–Jun	2,178	1,315	3,421	2,507	2,732	4,738	7,224	3,035	5,153	7,010	6,559	3,240	9,234	10,355	4,907	2,677	54.56
28–Jun	1,103	1,697	4,324	2,949	2,174	4,771	6,728	2,264	5,022	5,644	6,259	6,302	6,881	10,810	4,781	2,530	52.91
29–Jun	1,604	1,450	3,845	3,421	2,130	4,304	4,453	2,147	3,576	6,836	6,220	6,490	4,499	10,439	4,530	2,533	55.92
30–Jun	1,632	1,899	3,465	2,378	2,313	6,146	5,449	2,139	3,771	4,636	6,497	7,354	3,875	9,113	4,412	2,261	51.24
01–Jul	1,587	2,851	3,559	2,723	2,190	6,106	8,226	2,620	3,584	2,012	5,602	7,930	4,323	7,303	4,315	2,215	51.3323
02–Jul	2,533	2,524	3,365	2,606	4,420	6,113	7,554	2,608	3,152	3,406	4,680	5,296	5,067	5,109	4,174	1,489	35.67889
03–Jul	2,527	2,859	4,104	2,548	5,751	6,026	8,581	1,819	2,311	4,096	4,222	4,976	4,682	6,335	4,346	1,825	41.99069
04–Jul	2,980	3,806	2,934	4,094	5,245	6,943	6,515	3,536	1,805	7,100	3,532	7,369	5,665	6,680	4,872	1,779	36.50896
05–Jul	2,269	3,008	2,879	4,256	4,995	5,347	6,662	3,254	1,499	4,351	3,304	10,739	7,998	5,845	4,743	2,386	50.29574
06–Jul	1,623	1,996	3,025	3,476	8,300	3,973	5,449	4,664	2,609	3,393	3,510	10,024	7,749	8,213	4,586	2,255	49.16865
07–Jul	1,152	892	3,291	3,863	6,171	4,209	4,040	3,627	2,991	5,617	4,324	10,236	5,700	6,221	4,452	2,248	50.4978
08–Jul	831	2,091	2,995	3,774	3,990	4,080	3,906	3,693	2,860	6,616	8,499	11,113	5,192	7,067	4,779	2,620	54.81744
09–Jul	947	3,190	2,817	3,449	2,210	3,353	3,210	6,827	3,077	6,352	5,167	10,761	5,153	6,452	4,497	2,409	53.56511
10–Jul	1,252	4,209	3,842	2,942	2,070	3,644	2,927	10,607	5,435	6,585	6,347	9,506	6,620	4,609	5,171	2,731	52.81835
11–Jul	841	3,684	5,763	2,271	1,980	4,454	3,608	5,457	5,115	5,322	7,620	8,453	5,402	4,477	4,803	1,996	43.354
12–Jul	341	3,262	4,788	3,468	3,420	4,541	4,280	6,329	5,042	5,757	7,881	11,953	9,338	4,817	5,373	2,755	51.27248
13–Jul	167	3,144	1,725	2,265	4,032	4,543	4,582	5,252	3,696	6,583	7,087	9,329	11,432	3,968	4,843	2,676	59.37856
14–Jul	290	4,124	1,679	2,596	4,339	5,619	6,573	6,113	3,530	6,439	7,012	10,270	8,206	7,497	5,320	2,615	49.14254
15–Jul	275	3,535	1,743	3,691	4,714	6,496	5,521	5,024	4,699	5,722	6,924	12,283	8,309	7,549	5,463	2,818	51.5833
16–Jul	538	5,175	2,515	2,580	3,561	6,970	6,755	5,339	2,227	6,259	5,457	10,897	6,093	9,670	5,288	2,767	52.32955
17–Jul	304	3,555	3,419	780	2,925	6,327	4,955	5,960	4,108	4,467	4,877	8,903	6,259	9,667	4,750	2,539	53.44963
18–Jul	284	3,760	5,678	6,833	3,413	4,326	4,736	5,110	4,993	4,620	3,857	11,611	5,726	7,339	5,320	2,580	48.49606
19–Jul	321	3,344	5,613	20,975	4,296	3,703	3,140	4,560	6,066	4,127	4,583	10,567	5,975	7,512	6,056	4,711	77.79871
20–Jul	238	2,716	5,060	20,511	3,920	3,966	3,389	6,176	5,997	3,634	4,463	10,189	4,315	10,679	6,234	4,815	77.24245
21–Jul	61	2,583	3,826	15,741	4,049	4,463	3,204	4,128	4,746	2,441	3,964	8,639	2,534	10,267	5,048	3,842	76.12111
22–Jul	18	2,012	3,173	6,566	3,871	4,881	3,780	3,158	3,408	1,273	2,797	6,908	2,457	9,700	4,000	2,630	65.74349
23–Jul	15	1,915	2,143	5,787	3,099	3,603	3,205	2,670	2,909	1,002	3,429	6,103	3,901	9,016	3,643	2,397	65.81617
24–Jul	40	2,162	1,353	5,063	3,061	3,903	2,198	2,162	2,633	625	3,900	6,250	2,883	4,244	2,893	1,628	56.28538
25–Jul	13	1,112	1,623	3,391	3,874	4,535	1,937	2,449	2,292	2,014	4,023	5,303	2,050	3,065	2,656	1,351	50.85427
26–Jul		771	1,256	2,493	2,596	3,839	1,687	1,974	1,799	368	4,142	5,706	2,257	4,421	2,562	1,493	58.27915
27–Jul		318	1,198	2,451	2,247	3,687	1,391	2,191	1,626	626	3,920	5,699	2,685	3,884	2,471	1,463	59.21791
28–Jul		367	698	2,785	2,375	5,234	1,004	2,839	1,797	2,494	3,452	4,926	1,934	4,793	2,671	1,522	56.99727
29–Jul		365	400	3,686	1,426	4,138	891	2,813	1,563	2,341	3,476	4,150	2,808	5,354	2,570	1,510	58.76303
30–Jul		491	470	3,614	963	3,512	938	2,790	1,489	2,075	2,423	2,519	2,462	4,710	2,204	1,263	57.31857
31–Jul		703	353	3,802	1,176	1,835	1,093	1,848	1,259	2,226	1,920	1,551	2,550	2,901	1,786	900	50.37073
01–Aug		758	825	3,396	511	1,912	1,047	1,070	1,172	2,726	1,438	2,299	3,839		1,749	1,045	59.76154
02–Aug		379	1,034	2,304	942	2,211	1,068	703	1,045	1,299	1,098	1,744	5,249		1,591	1,230	77.31648
03–Aug		227	764	1,913	494	2,088	1,213		770	1,702					1,146	647	56.41681
04–Aug		286	708	1,297	581	2,697	1,118		814	1,499					1,150	756	65.75834
05–Aug		173	756	1,181	122		1,009		435	516					599	373	62.2471
06–Aug		103	877	1,170			533		416						620	370	59.71947
07–Aug		76	615						192						294	232	76.69925
08–Aug			166						33						100	67	66.83417
09–Aug			239						47						143	96	67.13287
Total	107,011	237,173	276,538	535,263	467,306	545,724	536,806	436,313	508,600	483,478	488,396	607,797	581,859	579,412	420,220	183,068	

Apendix 2. Cumulative daily salmon escapement estimates, Miles Lake sonar, Copper River, 1978–1991.

Date	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Average Daily Count	S.D.	C.V.
17–May				5,372								732			3,052	2,320	76.02
18–May		381	218	15,037								4,392			5,007	6,027	120.36
19–May		868	385	26,446			725				313	10,980			6,620	9,649	145.76
20–May		1,715	606	37,179			2,649			167	1,190	17,915			8,774	12,962	147.72
21–May		2,914	694	46,908			4,635			203	2,630	22,749	1,121	1,087	9,216	14,882	161.49
22–May		4,830	1,085	54,466			9,759			685	4,886	26,779	5,964	2,804	12,362	16,653	134.71
23–May		7,731	1,679	60,680		3,310	14,801			2,417	9,964	33,251	13,141	5,965	15,294	17,478	114.28
24–May		11,133	2,173	73,665	90	11,930	19,287			4,457	20,997	40,699	25,064	8,430	19,811	20,379	102.87
25–May		13,530	2,886	86,481	583	23,517	22,407		534	8,720	30,975	45,357	39,397	11,476	23,822	23,617	99.14
26–May	502	18,457	3,943	92,864	1,606	34,092	27,052		2,228	15,835	39,922	53,675	50,734	18,643	27,658	25,697	92.91
27–May	1,339	25,278	6,058	95,706	13,697	42,753	32,888		4,320	28,011	53,169	66,818	62,794	22,032	34,989	27,093	77.43
28–May	2,386	28,046	7,751	98,266	61,000	51,209	37,866	1,031	7,704	44,403	67,370	80,698	70,228	25,965	41,709	30,024	71.98
29–May	3,047	31,951	8,831	100,426	80,671	57,589	44,992	1,448	10,097	58,888	77,392	91,375	79,404	30,382	48,321	33,265	68.84
30–May	6,288	39,433	10,734	112,248	89,452	65,885	49,943	2,047	13,270	77,084	84,198	96,750	88,945	39,744	55,430	36,050	65.04
31–May	8,837	48,086	14,354	133,374	100,841	83,008	54,221	3,805	17,420	95,624	91,784	104,066	99,286	56,577	65,092	40,393	62.05
01–Jun	11,453	52,166	19,611	151,789	116,226	101,436	62,757	7,267	24,421	112,019	96,989	111,107	109,314	95,536	76,578	44,674	58.34
02–Jun	14,264	55,631	26,672	175,560	133,439	115,850	71,240	13,993	45,059	126,404	100,547	116,341	119,223	110,093	87,451	47,995	54.88
03–Jun	16,101	59,167	34,109	192,276	146,822	128,987	80,970	24,684	65,296	144,070	105,173	123,208	127,799	128,766	98,388	50,643	51.47
04–Jun	19,357	61,945	43,105	202,031	159,177	144,344	93,466	48,956	91,922	158,702	113,050	131,763	135,371	140,454	110,260	50,582	45.88
05–Jun	22,327	66,297	52,851	212,509	173,963	163,454	110,194	79,463	119,856	169,664	119,805	139,275	145,544	148,894	123,151	50,863	41.30
06–Jun	25,645	72,750	58,258	224,484	189,568	177,523	128,291	112,416	134,383	173,986	128,700	146,994	155,954	170,030	135,642	52,396	38.63
07–Jun	29,453	79,781	60,351	238,069	202,074	196,832	146,806	139,672	144,041	179,741	137,796	159,687	167,091	178,595	147,142	55,055	37.42
08–Jun	32,728	90,859	61,700	252,481	210,504	212,926	173,425	170,597	168,979	186,107	149,118	174,252	174,728	158,365	158,341	57,386	36.24
09–Jun	34,980	98,844	65,243	268,175	217,521	224,341	193,901	200,299	197,221	194,029	163,759	183,692	184,633	170,030	171,191	61,147	35.72
10–Jun	38,455	104,049	72,544	281,031	225,120	232,350	213,176	212,309	227,173	205,582	178,975	195,818	196,293	178,595	182,962	64,226	35.10
11–Jun	40,945	108,475	84,576	288,908	232,999	241,913	230,413	224,135	252,591	216,776	195,230	205,461	212,474	199,387	195,307	66,657	34.13
12–Jun	43,027	110,702	96,160	293,752	241,586	255,205	252,119	232,366	269,085	223,282	210,189	213,737	236,403	208,453	206,148	69,283	33.61
13–Jun	45,446	114,605	103,760	297,308	251,518	268,649	264,191	239,195	280,538	227,335	220,940	224,363	260,851	217,689	215,456	71,649	33.25
14–Jun	48,281	117,168	109,421	302,536	264,069	282,480	270,172	245,995	291,931	235,388	230,322	237,911	275,153	232,656	224,535	74,110	33.01
15–Jun	51,194	120,519	116,729	309,607	276,746	298,395	280,463	254,820	300,678	240,873	240,232	247,833	283,543	232,656	232,449	76,288	32.82
16–Jun	53,976	123,992	122,384	316,492	290,341	306,333	294,393	264,167	310,777	246,389	246,716	256,722	293,655	247,023	240,954	78,611	32.62
17–Jun	56,755	128,632	129,573	322,959	302,371	312,004	314,202	270,437	319,549	251,795	251,626	266,742	306,350	257,152	249,296	80,796	32.41
18–Jun	59,016	132,543	136,314	327,524	308,915	317,693	327,052	274,175	328,599	256,610	258,095	277,873	314,402	268,203	256,215	82,281	32.11
19–Jun	62,051	135,956	138,705	330,509	313,284	324,154	334,526	277,426	336,509	260,593	265,950	286,218	324,165	281,124	262,226	83,725	31.93
20–Jun	65,086	137,910	142,302	333,400	316,636	331,536	343,784	279,849	343,749	264,526	273,902	293,793	333,480	295,270	268,230	85,332	31.81
21–Jun	67,601	140,133	146,444	336,846	319,962	339,660	350,943	281,910	350,490	268,450	279,672	300,962	343,772	304,020	273,635	86,832	31.73
22–Jun	69,669	142,718	150,398	340,843	324,449	347,665	356,465	284,673	359,516	274,629	286,657	309,830	353,929	311,850	279,535	88,547	31.68
23–Jun	72,510	145,583	154,294	345,206	331,480	355,193	362,378	288,042	367,526	284,940	294,356	315,680	364,095	318,208	285,678	90,069	31.53
24–Jun	75,128	147,460	159,511	349,857	337,809	361,202	369,119	290,992	374,494	300,648	299,938	319,607	373,435	324,171	291,669	91,430	31.35
25–Jun	77,256	150,473	164,615	353,255	342,712	366,428	375,622	292,577	380,225	317,165	305,535	322,603	383,445	331,831	297,410	92,699	31.17
26–Jun	79,027	152,446	168,210	355,667	347,128	372,066	380,007	294,958	385,635	329,665	311,913	326,029	390,257	341,331	302,453	94,003	31.08
27–Jun	81,205	153,761	171,631	358,174	349,860	376,804	387,231	297,993	390,788	336,675	318,472	329,269	399,491	351,686	307,360	95,512	31.07
28–Jun	82,308	155,458	175,955	361,123	352,034	381,575	393,959	300,257	395,810	342,319	324,731	335,571	406,372	362,496	312,141	96,954	31.06
29–Jun	83,912	156,908	179,800	364,544	354,164	385,879	398,412	302,404	399,388	349,155	332,951	342,061	410,871	372,935	316,670	98,072	30.97
30–Jun	85,544	158,807	183,285	366,822	356,477	392,025	404,861	304,543	403,159	353,791	339,448	349,415	414,846	382,048	321,082	99,261	30.91
01–Jul	87,131	161,458	186,824	369,645	358,667	398,131	413,087	307,163	406,743	355,803	345,050	357,345	419,169	389,351	325,398	100,377	30.85
02–Jul	89,664	163,982	190,189	372,251	363,087	404,244	420,641	309,771	409,895	359,209	349,730	362,641	424,236	394,460	329,571	101,282	30.73
03–Jul	92,191	166,841	194,293	374,799	368,838	410,270	429,222	311,590	412,206	363,305	353,952	367,617	428,918	400,795	333,917	102,180	30.60
04–Jul	95,171	170,647	197,227	378,893	374,083	417,213	435,737	315,126	414,011	370,405	357,484	374,986	434,583	407,475	338,789	103,108	30.43
05–Jul	97,440	173,655	200,106	383,149	379,078	422,560	442,399	318,380	415,510	374,756	360,788	385,725	442,581	413,320	343,532	104,332	30.37
06–Jul	99,063	175,651	203,131	386,625	385,378	426,533	447,848	323,044	418,319	378,149	364,298	395,749	450,330	419,533	348,118	105,660	30.35
07–Jul	100,215	176,543	206,422	390,488	391,549	430,742	451,888	326,671	421,310	383,766	368,622	405,985	456,030	425,754	352,570	107,071	30.37
08–Jul	101,046	178,634	209,417	394,262	395,539	434,822	455,794	330,564	424,170	390,392	377,121	417,098	461,222	432,822	357,349	108,479	30.36
09–Jul	101,993	181,824	212,234	397,711	397,749	438,175	459,004	337,391	427,247	396,734	382,288	427,859	466,375	439,274	361,847	109,527	30.27
10–Jul	103,245	186,033	215,676	400,653	399,819	441,819	461,931	347,998	432,662	405,319	386,535	437,365	472,895	443,883	367,018	110,416	30.08
11–Jul	104,086	189,717	221,639	402,924	401,799	446,273	465,539	353,455	437,797	410,641	396,255	445,818	478,397	448,360	371,621	111,187	29.92
12–Jul	104,427	192,979	226,427	406,392	405,219	450,814	469,819	359,784	442,839	416,398	404,136	457,771	487,735	453,177	376,994	112,778	29.92
13–Jul	104,594	196,123	228,152	408,657	409,251	455,357	474,401	365,036	446,535	422,981	411,223	467,100	499,167	457,145	381,837	114,689	30.04
14–Jul	104,884	200,247	229,831	411,253	413,590	461,176	480,974	371,149	450,065	429,420	418,235	477,370	507,373	464,642	387,158	116,645	30.13
15–Jul	105,159	203,782	231,574	414,944	418,304	467,672	486,495	376,173	454,764	435,142	425,159	489,653	515,682	472,191	392,621	118,841	30.27
16–Jul	105,697	208,957	234,089	417,524	421,865	474,642	493,250	381,512	456,991	441,401	430,616	500,550	521,775	481,861	397,909	120,567	30.30
17–Jul	106,001	212,512	237,508	418,304	424,790	480,969	496,205	387,472	461,099	445,868	435,493	509,453	528,034	491,527	402,660	122,196	30.35
18–Jul	106,285	216,272	243,386	426,937	428,203	485,295	502,941	392,582	466,092	450,488	439,350	521,264	533,760	498,866	407,980	123,620	30.30
19–Jul	106,606	219,616	248,999	447,912	432,499	488,998	506,081	397,142	472,158	454,615	443,933	531,831	539,735	506,378	414,036	125,225	30.24
20–Jul	106,844	222,332	254,059	468,423	436,419	492,998	509,470	405,316	478,155	458,249	448,416	542,000	544,050	517,058	420,270	127,106	30.24
21–Jul	108,925	224,915	257,885	484,164	440,468	497,449	512,674	409,446	482,901	460,690	452,360	550,639	546,584	527,324	425,317	128,858	30.30
22–Jul	106,943	226,927	261,058	490,730	444,339	502,330	516,454	412,604	486,309	461,963	455,177	559,547	549,041	537,025	429,318	130,459	30.39
23–Jul	106,958	228,842	263,201	496,517	447,438	505,933	519,659	415,474	489,218	462,965	458,606	567,650	552,942	546,041	432,960	132,072	30.50
24–Jul	106,998	231,024	264,554	501,560	450,499	509,836	521,857	417,636	491,851	463,590	462,506	573,900	555,825	550,285	435,853	133,186	30.56
25–Jul	107,011	232,136	266,177	504,871	453,873	514,371	523,794	420,085	494,143	465,604	466,529	579,203	557,875	553,350	438,509	134,176	30.60
26–Jul		232,907	267,433	507,464	456,469	518,210	525,481	422,059	495,942	465,972	470,671	584,909	560,132	557,771	440,868	135,265	30.68
27–Jul		233,225	268,631	509,915	458,716	521,897	526,872	424,250	497,568	466,598	474,591	590,608	563,017	561,655	443,182	136,392	30.78
28–Jul		233,612	269,329	512,700	461,091	527,131	527,876	427,089	499,365	469,092	478,043	595,534	564,951	566,447	445,662	137,576	30.87
29–Jul		233,977	269,729	516,386	462,517	531,269	528,767	429,902	500,928	471,433	481,519	599,684	567,759	571,801	448,049	138,791	30.98
30–Jul		234,468	270,199	520,200	463,480	534,781	529,705	432,692	502,417	473,508	483,942	602,203	570,221	576,511	450,096	139,757	31.05
31–Jul		235,171	270,552	524,002	464,656	536,816	530,798	434,540	503,678	475,794	485,862	603,754	572,771	579,412	451,754	140,459	31.09
01–Aug		235,929	271,377	527,398	465,167	538,528	531,845	435,610	504,848	478,460	487,300	606,053	576,610		443,549	141,798	31.97
02–Aug		236,308	272,411	529,702	466,109	540,739	532,933	436,313	505,893	479,759	488,398	607,797	581,859		445,018	142,560	32.03
03–Aug		236,535	273,175	531,615	466,603	542,827	534,146		506,663	481,461					411,635	143,798	34.93
04–Aug		236,821	273,883	532,912	467,184	545,724	535,264		507,477	482,960					412,555	144,313	34.98
05–Aug		236,994	274,841	534,093	467,306		536,273		507,912	483,478					412,975	144,462	34.98
06–Aug		237,097	275,518	535,263			536,806		508,328						413,284	144,537	34.97
07–Aug		237,173	276,133						508,520						413,373	144,482	34.95
08–Aug			276,299						508,553						413,393	144,469	34.95
09–Aug			276,538						508,600						413,421	144,449	34.94